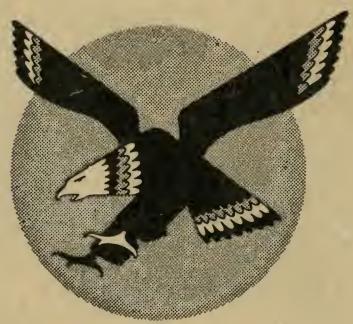


TOOL FABRICATION
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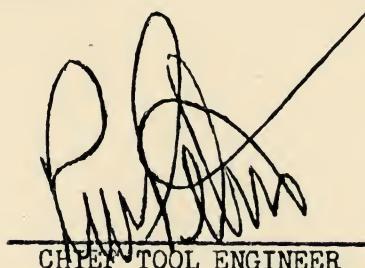
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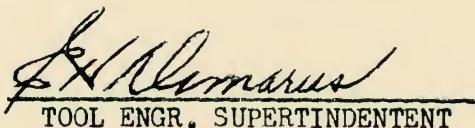
FOREWORD

THE TOOL FABRICATION PROCEDURE MANUAL IS COMPILED BY THE TOOL DESIGN DEPARTMENT. IT IS INTENDED AS A SOURCE OF INFORMATION AND GUIDE FOR THOSE CONCERNED WITH THE FABRICATION AND INSPECTION OF THE TYPE OF TOOLS WHICH NORMALLY DO NOT HAVE INDIVIDUAL DESIGNS AT CONVAIR. TOOLS OF TYPES REFERRED TO ARE FABRICATED BY TOOL MANUFACTURING DEPARTMENTS TO A GENERAL PATTERN, TYPICAL EXAMPLES OF THESE ARE SHOWN IN THIS MANUAL. DUE TO WIDE VARIETY OF APPLICATIONS OF SOME OF THESE TYPES OF TOOLING, LIKE PLASTIC TOOLING, VARIATIONS AND IMPROVISATIONS ARE LEFT TO SHOP DISCRETION AND ONLY A FEW TYPICAL ONES ARE SHOWN HERE.

IN ORDER TO MAKE THIS MANUAL OF OPTIMUM VALUE AND KEEP ABREAST OF CHANGING METHODS AND IMPROVED TECHNIQUES, THOSE CONCERNED WITH FABRICATION OF TOOL TYPES INCLUDED HEREIN SHOULD CONTACT TOOL DESIGN, STANDARDS SECTION CONCERNING ANY SUGGESTED CORRECTIONS, NEW METHODS OR ADDITIONS THEY MIGHT DEEM ADVISABLE.



REVISED 11-1-56


TOOL ENGR. SUPERINTENDENT


TOOL DESIGN SUPERVISOR

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
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APPROVED	

FOREWORD
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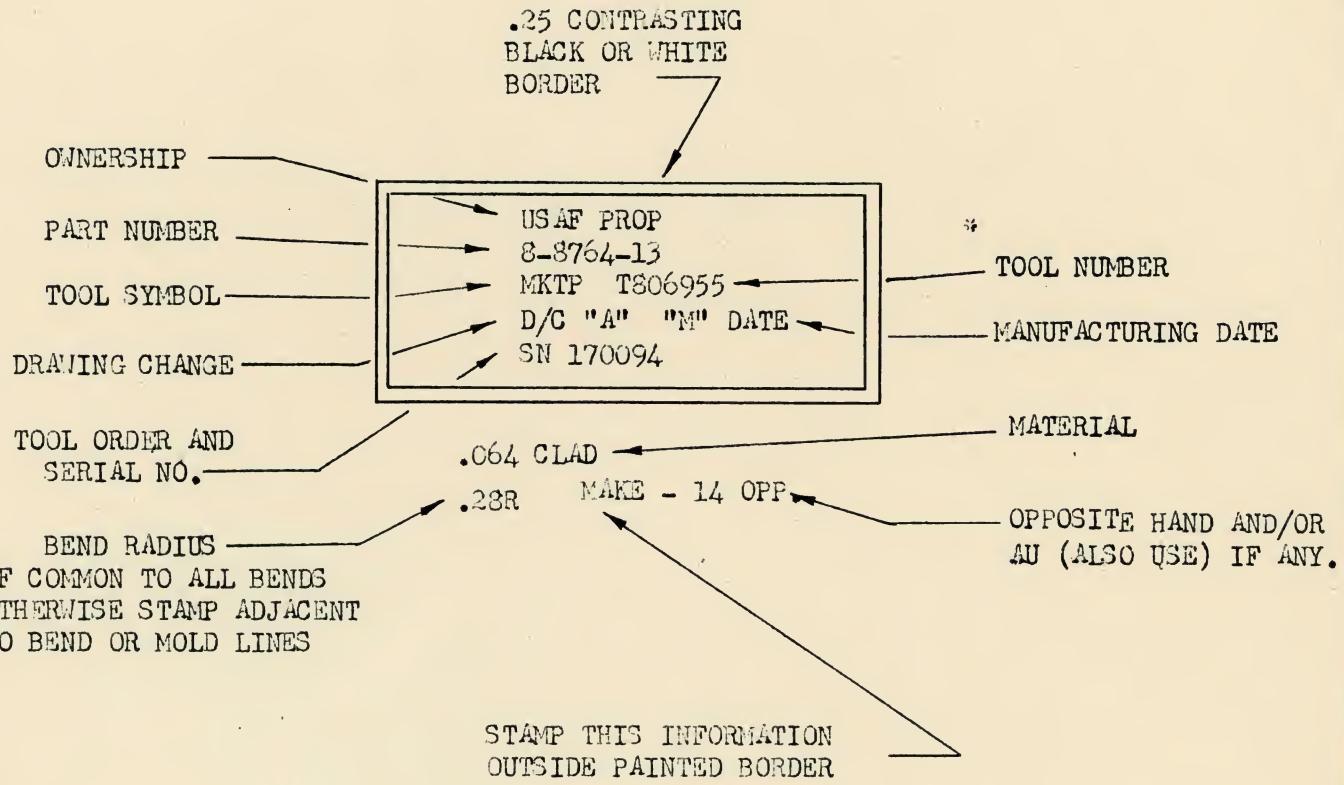
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* WHEN TOOL NUMBERS ARE ASSIGNED

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TYPICAL STAMPING PROCEDURE
FOR ALL TEMPLATES

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COLOR CODE FOR STANDARD HOLE SIZES		
HOLE SIZE	STD. SIZE FOR	SAN DIEGO COLOR
#39 (.0995)	3/32 RIVET	RED
#30 (.1285)	1/8 RIVET	WHITE
#26 (.1470)	#6 & #4 SCR.	ORANGE
#20 (.1610)	5/32 RIVET	YELLOW
#18 (.1695)	#8 SCREW	GRAY
#16 (.1770)	PIL HL FOR 3/16 HUCK BOLT & HI SHEAR RIVET	BROWN
#11 (.1910)	3/16 RIVET	BLUE
#1 (.2280)	#10 SCREW	BLACK
#B (.2380)	PIL HL. FOR 1/4 HUCK BOLT & HI-SHEAR RIVET	TURQUOISE
#F (.2570)	1/4 RIVET	GREEN
9/32 (.2812)	1/4 SCREW	PINK
9/16 (.2968)	PIL. HL. FOR 5/16 HUCK BOLT & HI SHEAR RIVET	PURPLE
5/16 (.3125)		SILVER
23/64 (.3593)	PIL. HL. FOR 3/8 HUCK BOLT & HI SHEAR RIVET	GOLD

STANDARD HOLE SIZES DRILLED, PUNCHED

HOLE DIA.	MAX. PLUS TOL.	RIVET SIZE	SCREW-SIZES		DRTP HOLE SIZE	MPPE HOLE SIZE	PILOT HOLE SIZE	HOLE DIA.	MAX. PLUS TOL.	BOLT SIZE	PILOT HOLE SIZE	MPPE HOLE SIZE
			TIGHT	LOOSE								
.047	.006				.161		----	.086	.005			
.067	.006	1/16			.191	.375	----	.191	.005	3/16	.161*	.500
.099*	.006	3/32			.250	.375	.099*	.250-	.005	1/4	.228*	.500
.128*	.006	1/8	#4		.250	.375	.128*	.312-	.005	5/16	.257*	.500
.147*	.006		#6	#4	.281	.375	.161*	.375-	.005	3/8	.312*	.625
.161*	.006	5/32		#6	.281	.375	.161*	.437-	.005	7/16	x	
.169*	.003		#8		.312	.375	.191*	.500	.005	1/2	x	
.191*	.008	3/16	#10	#8	.312	.500	.228*					
.228*	.008			#10	.312	.500	.257*					
.257*	.008	1/4		1/4	.375	.500						
.281*	.008				.437	.500						
.323	.008	5/16										
.386	.008	3/8										
.515	.008	1/2										

∅ FOR MATERIAL .080 OR UNDER
USE .161 PIL.

* MULTIPUNCH AVAILABLE IN THIS SIZE

x FOR PUNCHING WITH ROUND HOLE DIE USE .138 PILOT.

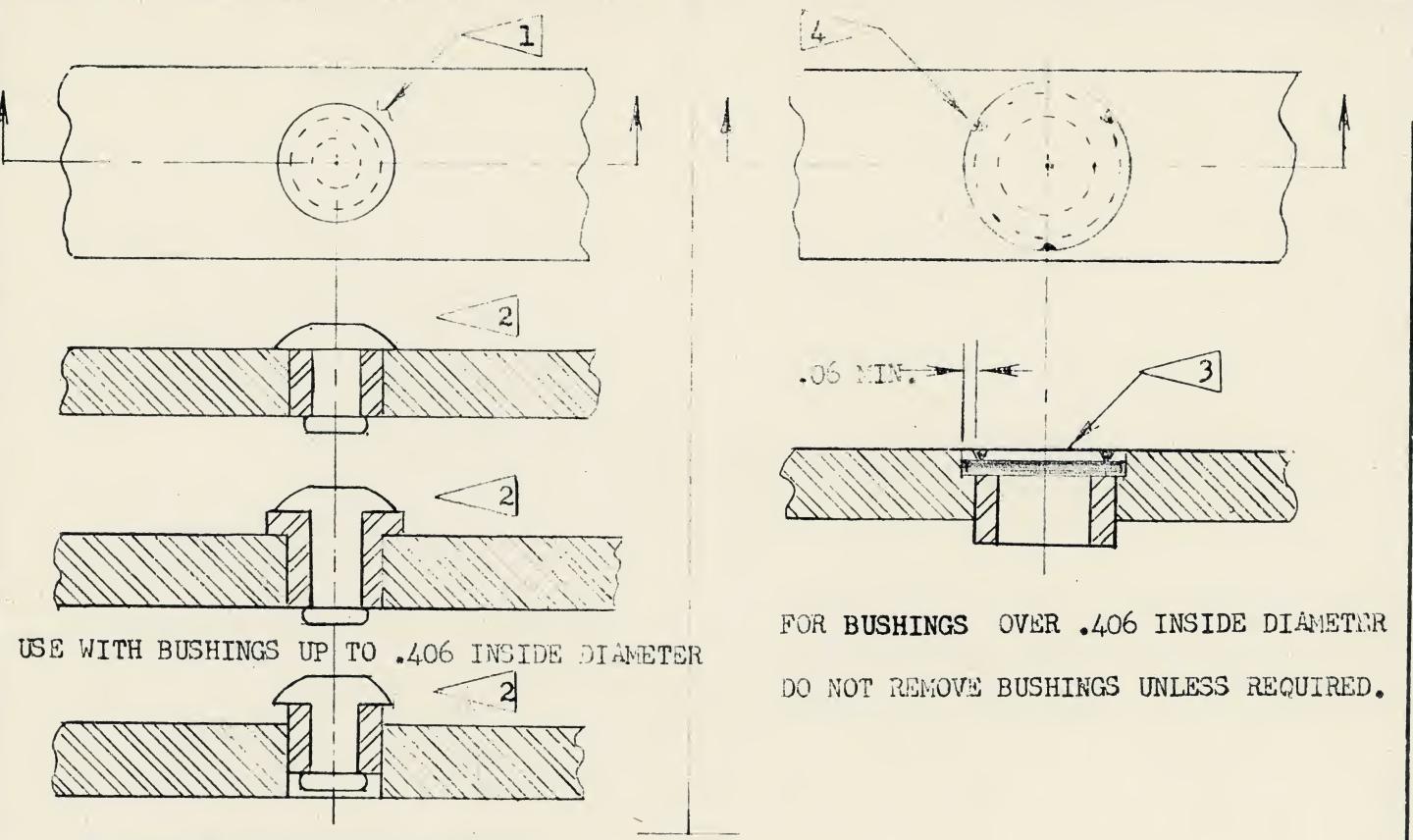
▲ WHEN A.N. BOLTS ARE NOT USED IN SHEAR THEY ARE CLASSIFIED AS SCREWS

■ USE .116 DIA. PILOT HOLE WHEN MATERIAL IS OVER .080 THICKNESS AND IS IN ONE ATTACHING MEMBER ONLY. THIS APPLIES TO PCDI AND CNDI ONLY.

- STANDARD REAMED SIZES

STANDARD HOLE SIZES

DRAWN	CANE 10-15-56	HOLE STANDARDS	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION PROCEDURES MANUAL
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APPROVED				
APPROVED	<i>C. L. Clegg</i> <i>M. W. Mays</i>			
				PAGE 8



FOR BUSHINGS OVER .406 INSIDE DIAMETER
DO NOT REMOVE BUSHINGS UNLESS REQUIRED.

ALTERNATE METHOD WHEN REQUIRED

- 1 TOOL PROOF STAMP TO APPEAR HERE.
- 2 AN-470 RIVET AL. AL.
- 3 METAL PUNCHING TO SUIT (.06 MIN. THICKNESS)
- 4 STAKE (3) PLACES WITH CENTER PUNCH AS SHOWN

METHODS OF DELETING HOLES IN DRJI - DRPE - DRFX
WHEN A GROUP OF HOLES IS TO BE DELETED, USE 1/8 STEEL PLATE SECURED WITH SEVERAL SCREWS. ALL HOLE DELETIONS MUST BE TOOL PROOFED BEFORE USING TOOL FOR PRODUCTION.

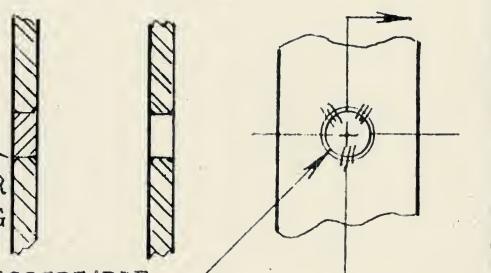
FOR MPPE & ALL TEMPLATES

USE PUNCHING OF SAME MATERIAL,
THICKNESS & HOLE DIA.
TACK WELD & GRIND FLUSH.
T.P. STAMP MUST APPEAR BEFORE
USING TOOL FOR PRODUCTION.

SLIGHT C'S'K
BOTH FACES OF
TEMP.

TACK WELD & GR
FLUSH PUNCHING

GLASS METHOD ACCEPTABLE
SUB. FOR LARGE TABLE
TYPE DRFX'S



CEMENT GLASS
CLOTH

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APPROVED	<i>Donald Wiles</i>

METHODS OF PLUGGING HOLES WHICH ARE TO BE
DELETED FROM DRJI; DRPE; DRFX; MPPE & TEMP.

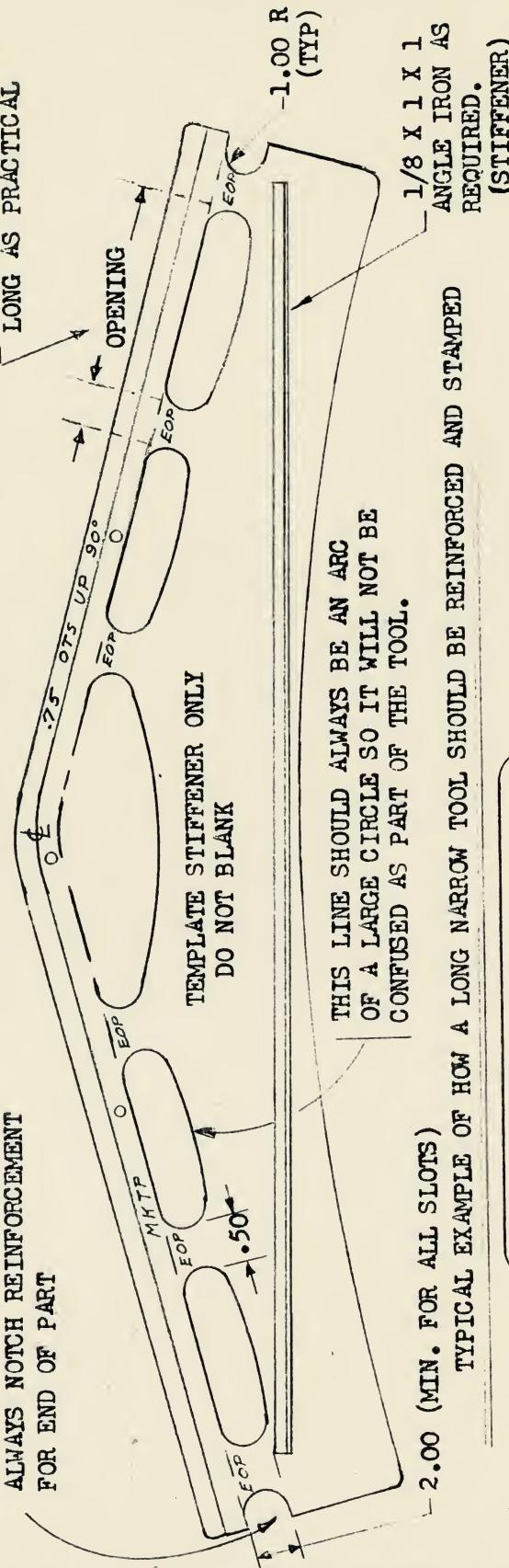
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TOOL LOFT PROCEDURE

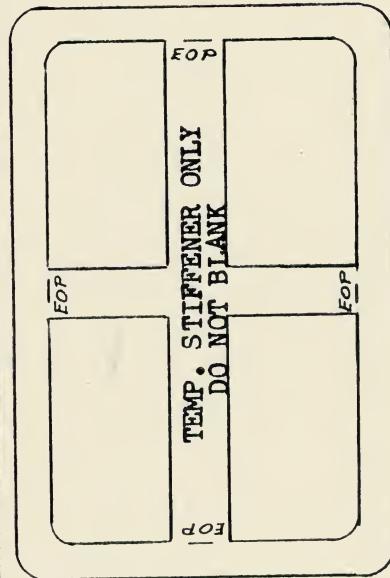
TOOL ILLUSTRATION

REINFORCEMENT OF TOOLS

ALWAYS NOTCH REINFORCEMENT
FOR END OF PART



TOOLS REQUIRING REINFORCING STRIPS
SHOULD BE PLAINLY MARKED AS SHOWN SO
THAT REINFORCING STRIPS WILL NOT BE
INCLUDED IN THE BLANKING DIE.



TYPICAL EXAMPLE OF A TOOL NEEDING REINFORCEMENT

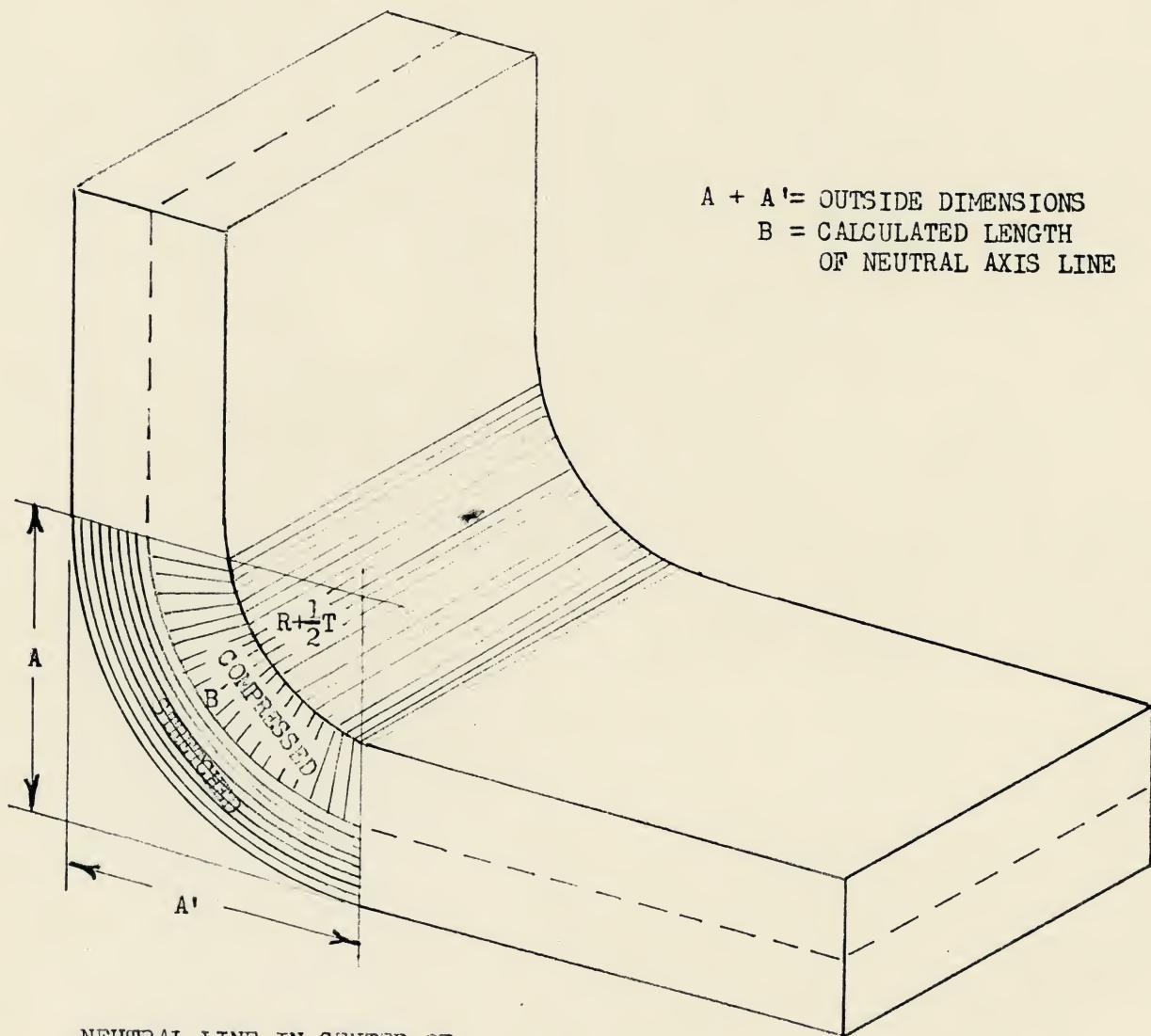
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REINFORCEMENT OF TEMPLATES WHERE NEEDED

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NEUTRAL LINE IN CENTER OF MATERIAL WHICH DOES NOT CHANGE IN LENGTH WHEN MATERIAL IS BENT.

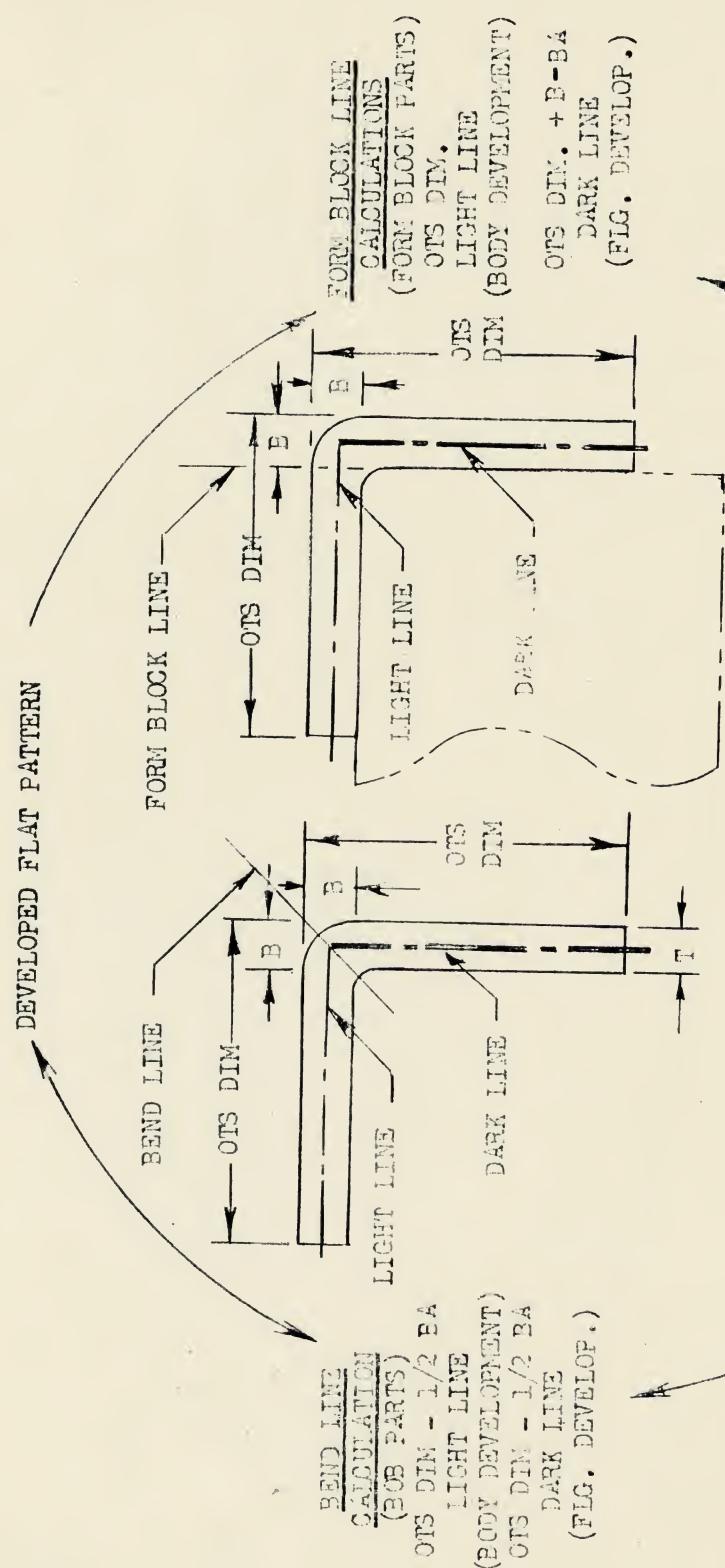
DIFFERENCE BETWEEN $A + A'$ AND B IS THE BEND ALLOWANCE FIGURED FROM TABLES

REFER TO CONVAIR "SET BACK TABLES" BOOK FOR CALCULATED SET BACK DIMENSIONS.

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TEMPLATE - BEND ALLOWANCE FORMULA

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SETBACKS, EMPIRICAL FORMULA: WHEREAS THE DIFFERENCE BETWEEN "D + D" AND "E" EQUALS A SETBACK, THE EMPIRICAL FORMULA SHALL BE

$$\text{SETBACK} = 2 \left[(R+T) \frac{\tan C}{2} \right] - \left[.01745 R + .00372 T \right] C$$

SET BACKS, NON-STANDARD THICKNESS OR BEND RADII: REFER TO "KIR" AND "K2T" TABLES IN SET-BACK BOOK.

COMPARISON OF LINES REQUIRED FOR BEND ON BRAKE AND BLOCK FORMED PARTS: REFER TO FIGURES #1 AND #2.

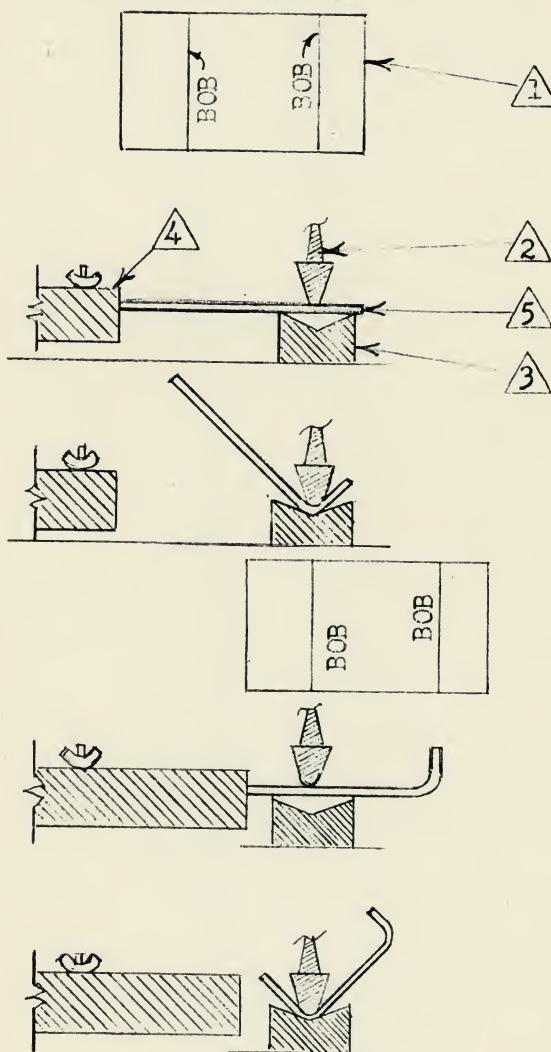


FIGURE #1

- 1 TEMPLATE SHOWING BOB LINES
- 2 BRAKE PUNCH
- 3 BRAKE DIE
- 4 ADJUSTABLE STOP
- 5 BLANKED PART

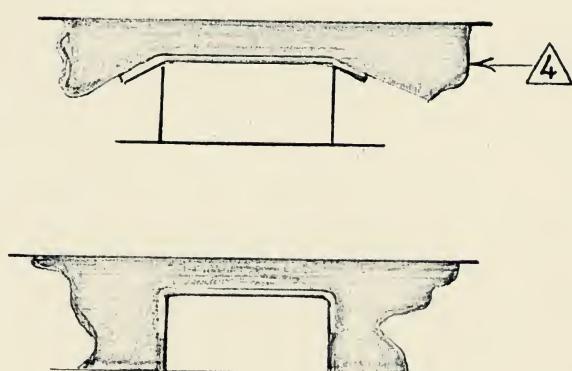
1 TEMPLATE SHOWING INSIDE MOLD LINES

2 FORM BLOCK

3 BLANKED PART

4 HYDRO-PRESS BLANKET

FIGURE #2



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"SET BACK FORMULAS" &
APPLICATION

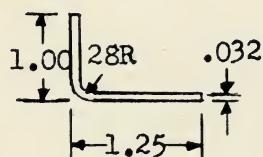
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FLAT PATTERN DEVELOPMENT FOR BEND ON BRAKE PARTS: A BOB (BEND ON BRAKE) LINE REPRESENTS THE STRIKING PLANE OF THE BRAKE PUNCH (AND IS THE CENTER OF THE BEND). DEVELOPMENT FOR BOB REQUIRES SUBTRACTION OF ONE HALF OF A SETBACK FROM THE OUTSIDE FLANGE DIMENSIONS AT EACH BEND.

EXAMPLE:



1.00 (OTS. DIMENSION)

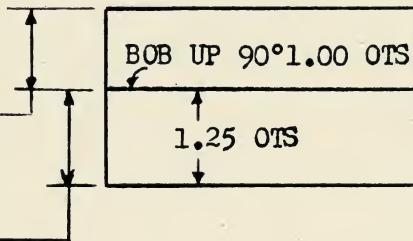
-.08 (1/2 S.B.)

.92 DEVELOPED WIDTH

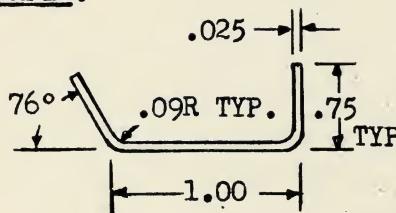
1.25 (OTS. DIMENSION)

-.08 (1/2 S.B.)

1.17 DEVELOPED WIDTH



EXAMPLE:



.75 (OTS. DIMENSION)

-.02 (1/2 S.B. 76°)

.73 DEVELOPED WIDTH

1.00 (OTS. - OTS. DIM.)

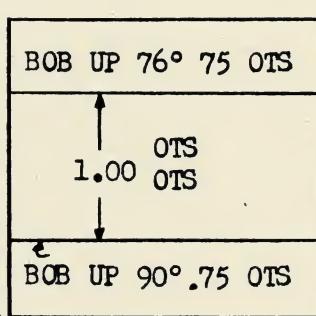
-.055 (1/2 S.B. 76° +
1/2 S.B. 90°)

.945 DEVELOPED WIDTH

.75 (OTS. DIMENSION)

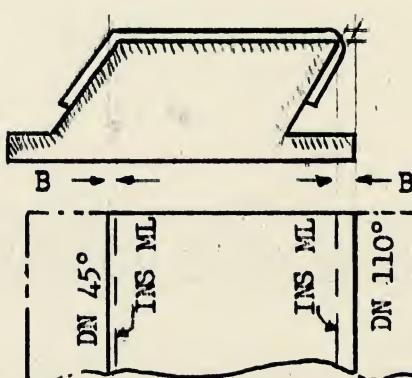
-.035 (1/2 S.B. 90°)

.715 DEVELOPED WIDTH



FLAT PATTERN DEVELOPMENT FOR BLOCK FORMED PARTS: TEMPLATES FOR BLOCK FORMED PARTS (HYDRO-PRESS, IMPACT-FORM, HAND-FORMED, ETC.) INDICATE THE MOLD LINES REQUIRED FOR FABRICATION OF THE FORM BLOCKS. FLAT PATTERN DEVELOPMENT FOR BLOCK FORMED PARTS REQUIRES USE OF "B" DIMENSIONS AND SETBACKS.

A "B" DIMENSION IS THE RELATIONSHIP OF INSIDE AND OUTSIDE MOLD LINES. "B" DIMENSIONS (AS TABULATED ACCORDING TO MATERIAL THICKNESS AND DEGREE OF BEND) WILL BE FOUND IN SET BACK BOOK.



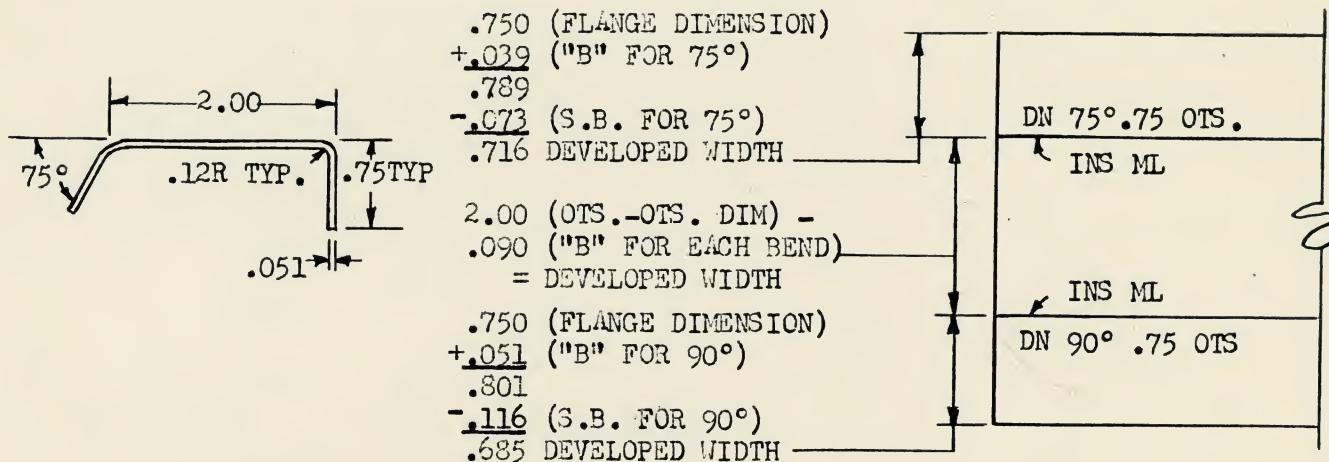
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FLAT PATTERN DEVELOPMENT FOR BEND
ON BRAKE TEMPLATES

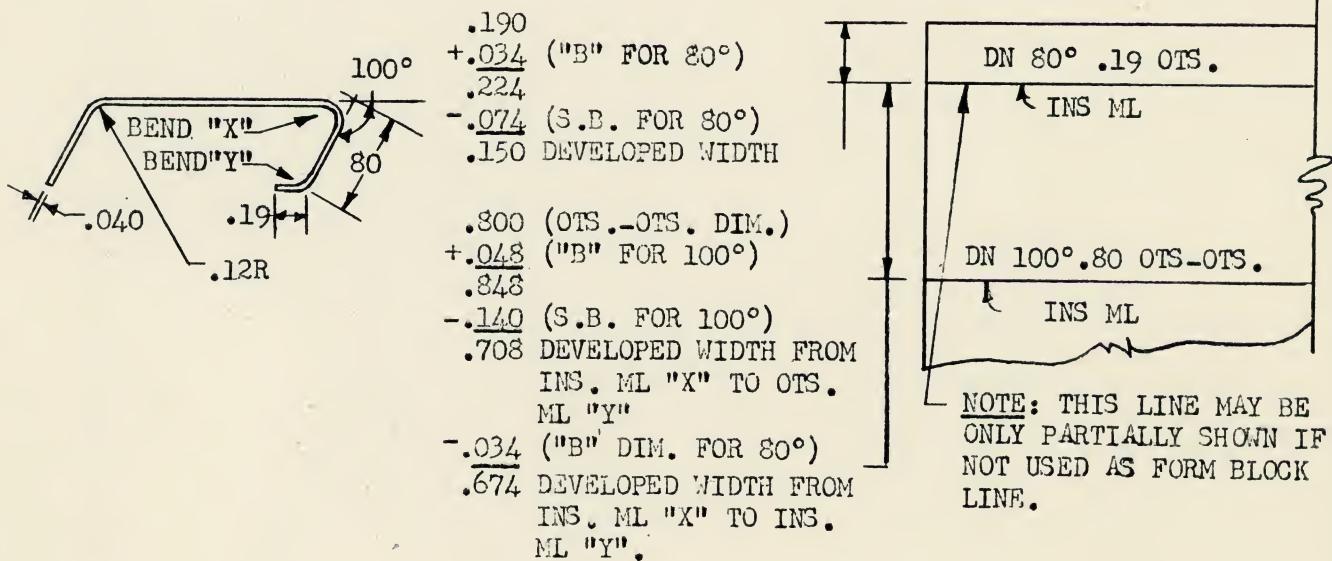
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TO DETERMINE FLANGE DEVELOPMENT FOR BLOCK FORMED FLAT PATTERNS, ADD A "B" DIMENSION TO THE FLANGE DIMENSION AND SUBTRACT A SETBACK.



DEVELOPMENT FOR ADDITIONAL FLANGES OR RETURN LIPS IS ACCOMPLISHED IN THE SAME MANNER AS SINGLE FLANGE DEVELOPMENT. PROCEEDING FROM THE WEB FACE, THE ADJACENT OUTSIDE-OUTSIDE FLANGE WOULD BE DEVELOPED INDICATING INSIDE MOLD LINE "Y".

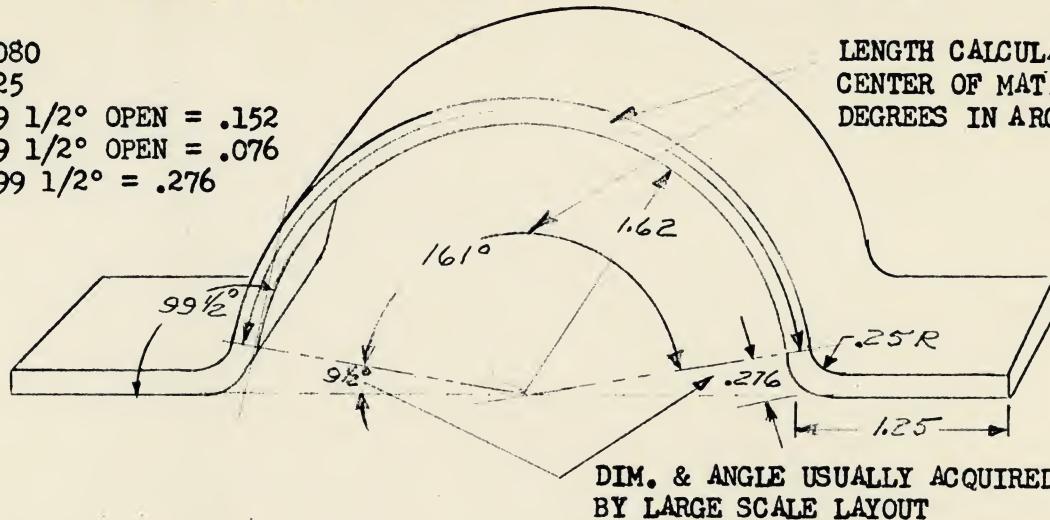


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TYPICAL EXAMPLE
BA TAKEN FROM "KIR" AND "K2T" SET BACK TABLES (REF.)

MAT = .080
BR = .25
BA FOR $9\frac{1}{2}^\circ$ OPEN = .152
 $\frac{1}{2}$ BA FOR $9\frac{1}{2}^\circ$ OPEN = .076
SB FOR $99\frac{1}{2}^\circ$ = .276

LENGTH CALCULATED AT
CENTER OF MAT. & NO.
DEGREES IN ARC.



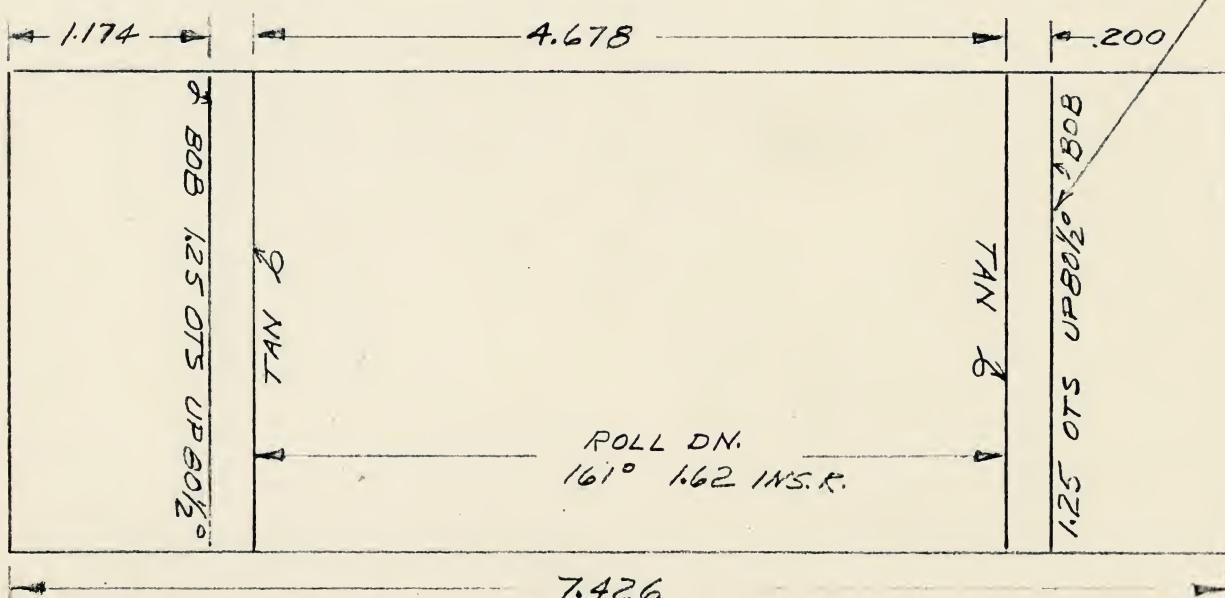
$$\frac{161}{360} (1.625 + 1.625 + .080) \times 3.1416 = 4.678 \text{ LENGTH ROLL SEGMENT}$$

$$.276 + 1.25 - .152 = 1.374 \text{ LENGTH FLANGE & BEND}$$

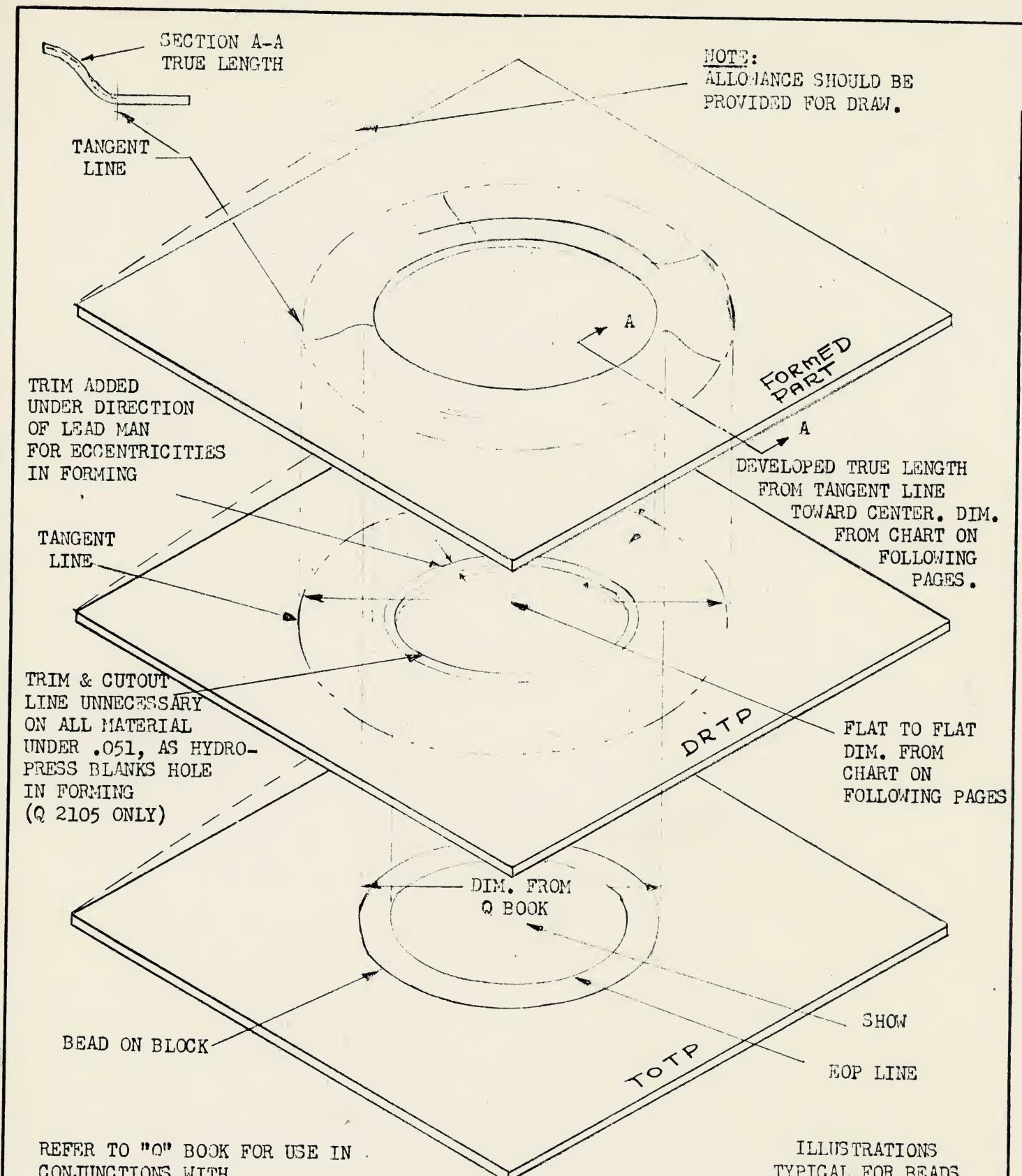
$$\begin{aligned} .276 - .076 &= .200 \text{ DISTANCE BEND LINE TO TANGENT LINE} \\ 1.25 - .076 &= \underline{1.174} \text{ DISTANCE BEND LINE TO END OF PART} \\ 1.374 &\quad (\text{CHECK}) \end{aligned}$$

$$1.374 + 4.678 + 1.374 = \underline{7.426} \text{ TOTAL DEVELOPMENT}$$

SHOW BEND LINE



DRAWN	CAME 10-25-56	TEMPLATE DEVELOPMENT FOR BEND ON BRAKE-FORMED PARTS	TOOL FABRICATION PROCEDURES MANUAL	
CHECKED	ROBBINS 11-1-56			
APPROVED				
APPROVED				
CONVAIR			PAGE 20	
A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO				



REFER TO "Q" BOOK FOR USE IN
CONJUNCTIONS WITH
ILLUSTRATIONS.

ILLUSTRATIONS
TYPICAL FOR BEADS
Q 2105 - Q2110 - Q2116

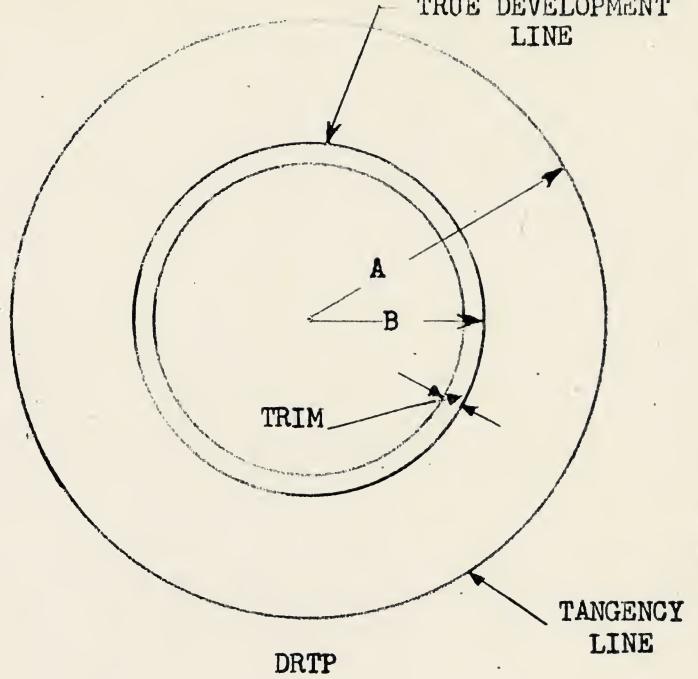
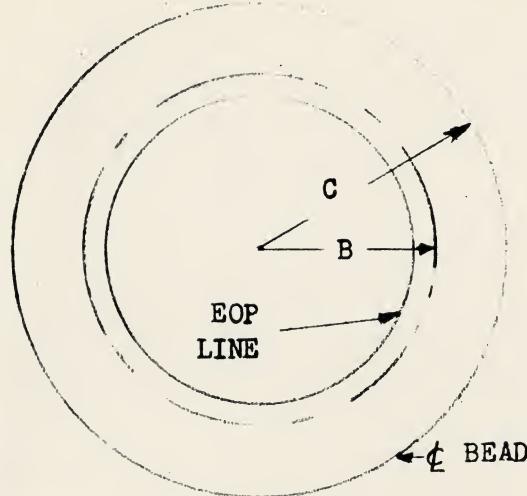
DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

DRILL TEMPLATE
CIRCULAR BEAD APPLICATION

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PROCEDURES
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FOR LINES REQUIRED ON TEMPLATES
SEE PRECEDING PAGE

REFERENCE: Q BOOK PAGE Q2105

DASH NUMBER	Q2105 BEAD			
	TOTP	DRTP		
	B *	C	A	B
1.375	.658	.75	1.125	.658
1.625	.783	.875	1.250	.783
1.875	.908	1.000	1.375	.908
2.125	1.033	1.125	1.500	1.033
2.375	1.138	1.250	1.703	1.138
2.625	1.263	1.375	1.830	1.263
2.875	1.388	1.500	1.953	1.388
3.125	1.513	1.625	2.078	1.513
3.375	1.638	1.750	2.203	1.638
3.875	1.888	2.000	2.453	1.888
4.375	2.108	2.250	2.750	2.108
4.875	2.358	2.500	3.000	2.358
5.375	2.608	2.750	3.250	2.608
5.875	2.858	3.000	3.500	2.858

* "B" DIMENSION TO HAVE TRIM SUBTRACTED FROM IT FOR E.O.P. LINE ON TOTP.

DRAWN	CAME 11-1-56	
CHECKED	ROBBINS 11-15-56	
APPROVED		
APPROVED		

DRILL TEMPLATE
CIRCULAR BEAD APPLICATION
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BEAD PROCEDURE
CHART TO BE USED IN CONJUNCTION WITH B DIMS
GIVEN IN Q BOOK UNDER Q 2116

MATERIAL	Q 2116		7/16 DEPTH	
	5/16 DEPTH	* DEVELOPED TRUE LENGTH DIM. TOWARD CENTER FROM OUTSIDE OF GIVEN BEAD (TANGENT LINE)	DIMS. TO BE ADDED TO RADII FOR TANGENCY OUTSIDE OF GIVEN BEAD (TANGENT LINE)	* DEVELOPED TRUE LENGTH DIM. TOWARD CENTER FROM OUTSIDE OF GIVEN BEAD (TANGENT LINE)
.020	.5525	.7285		
.025	.5562	.7292		
.032	.5590	.7300		
.040	.5635	.7332	.7780	.9965
.051	.5680	.7365	.7850	1.0025
.064	.5742	.7430	.7920	1.0085
.072	.5805	.7495	.7967	1.0100
.081	.5855	.7530	.8015	1.0125
.091	.5905	.7565	.8072	1.0175
.102	.6000	.7660	.8130	1.0225
.125	.6095	.7755	.8250	1.0345

* TRIM TO BE ADDED FROM THIS LINE TOWARD CENTER OF BEAD UNDER DIRECTION OF LEAD MAN.

Q 2156 BEAD

GAGE	-4	-7	-10	-14	-20
.020	7/8	1	1-1/4		
.032	1	1-1/4	1-1/4		
.040	1	1-1/4	1-1/2	1-7/8	
.051	1-1/4	1-3/8	1-5/8	2	
.064	1-1/2	1-5/8	1-7/8	2-1/4	
.072	1-1/2	1-3/4	2	2-3/8	
.081	1-5/8	1-7/8	2-1/8	2-1/2	
.091		2	2-1/4	2-5/8	3-1/4
.102		2-3/16	2-5/16	2-3/4	3-3/8
.128			2-3/8	3	3-1/2
.156			3	3-1/2	4

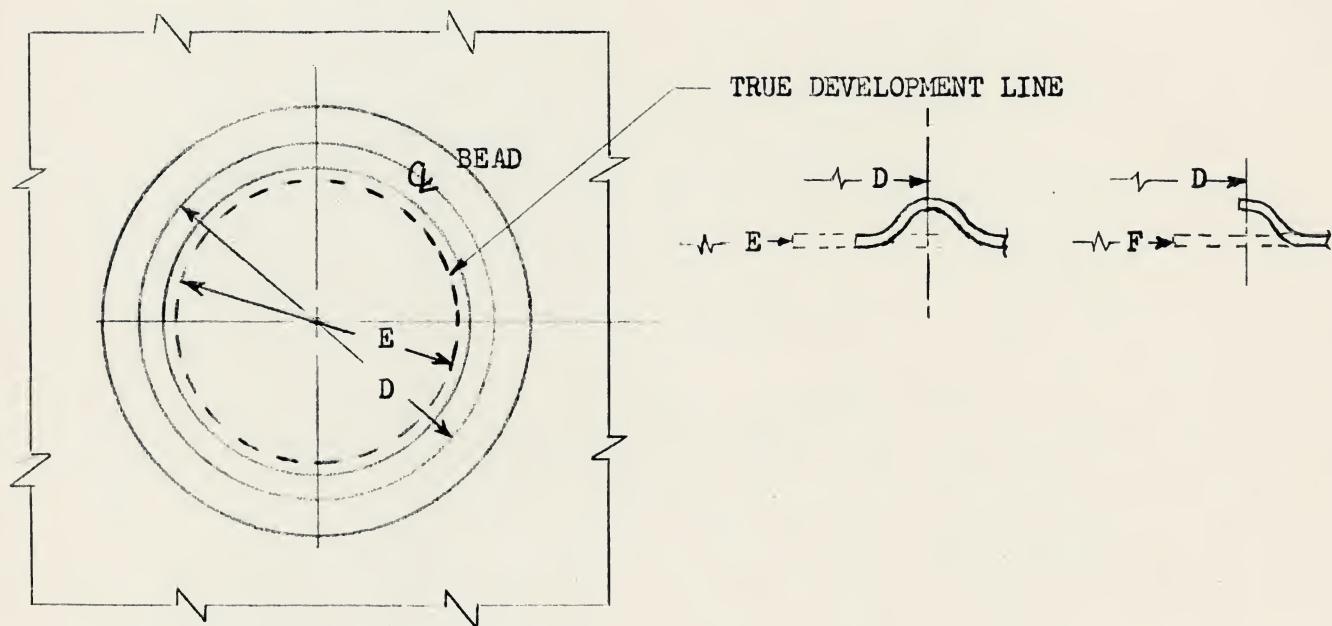
FLAT TO FLAT DISTANCE
FOR LINES REQUIRED ON TEMPLATES SEE PRECEDING PAGES

DRAWN	CAME 10-15-56	HYDRO PRESSED PARTS TEMP DEVELOPMENT CONVAIR <small>A DIVISION OF GENERAL DYNAMICS CORPORATION</small> <small>SAN DIEGO</small>	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 10-20-56		
APPROVED			
APPROVED			
		PAGE 23	

CHARTS & TABLES

BEAD PROCEDURE

Q 2106



DASH NO.	D	SEMI BEADED E	FULL BEADED F
3.5	3.5	3.15	1.80
4	4	3.65	2.30
4.5	4.5	4.15	2.80
5	5	4.65	3.30
6	6	5.65	4.30
7	7	6.65	5.30
7.5	7.5	7.15	5.80
8	8	7.65	6.30
9	9	8.65	7.30
11	11	10.65	9.30

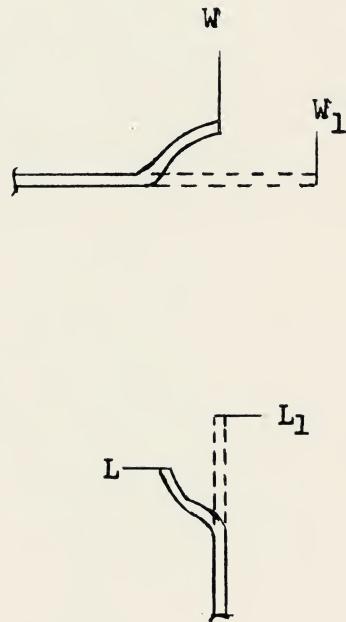
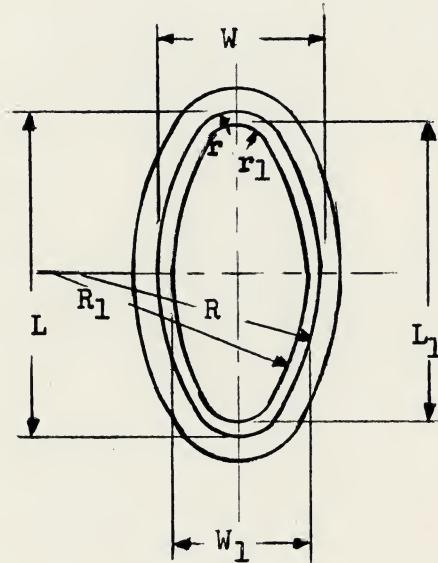
DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

HYDRO PRESSED PARTS
MARK TEMP DEVELOPMENTCONVAIR
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BEAD PROCEDURE

Q 2110



DASH NO.	W_1	L_1	R_1	r_1
4.0	1.8438	3.8438	3.8594	.64065
4.25	1.9688	4.0938	3.9844	.6719
4.75	2.2188	4.5938	4.2969	.77565
5.625	2.6563	5.4688	4.9844	.89065
6.5	3.0938	6.3438	5.6719	1.0162
7.0	3.3438	6.8438	6.20315	1.110
8.5	4.0938	8.3438	7.45315	1.32815

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

TEMPLATE DEV. - OVAL BEAD APPLICATION

TOOL FABRICATION
PROCEDURES
MANUAL

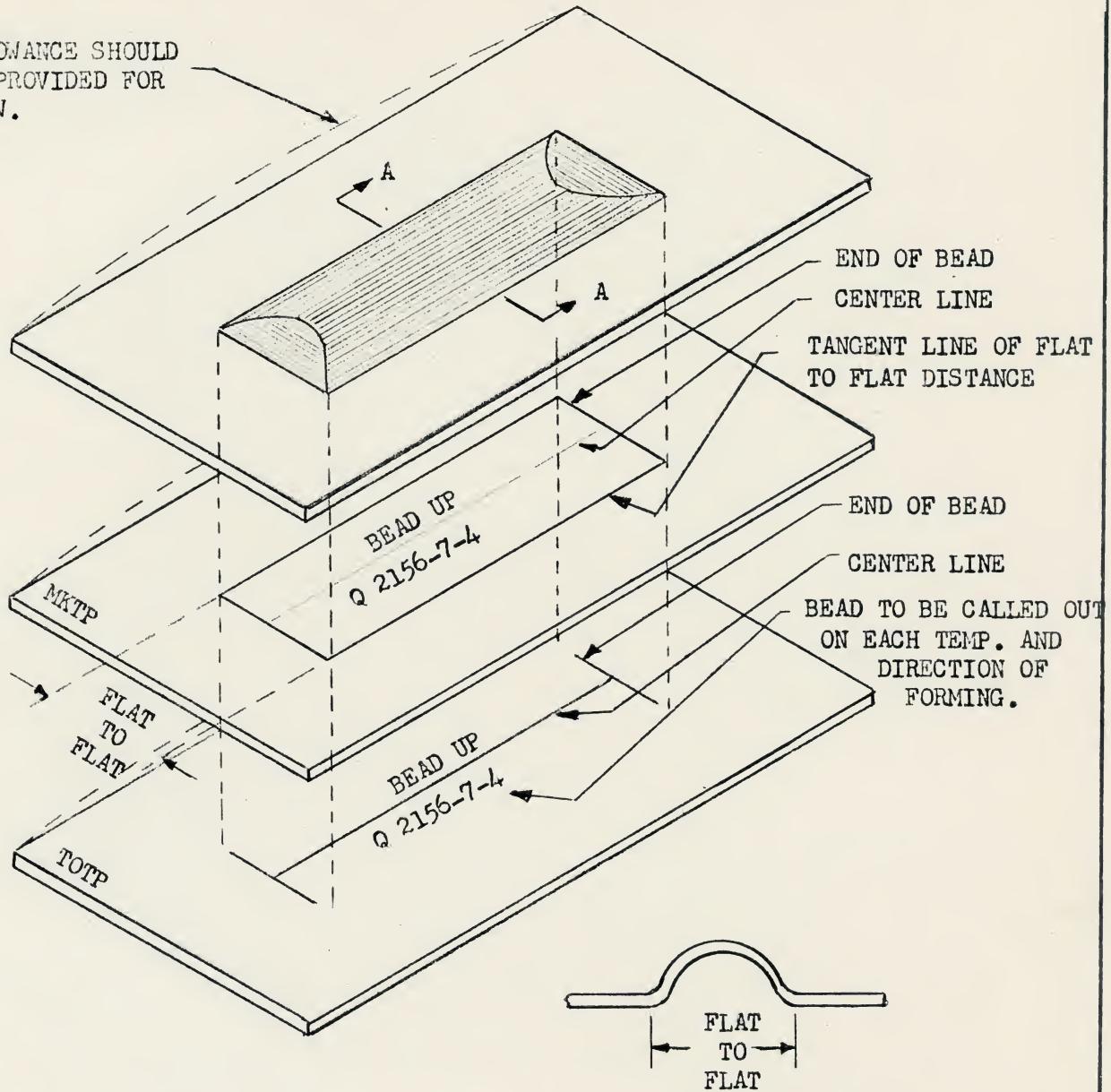
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TYPICAL EXAMPLE OF LINES TO BE SHOWN ON MKTP & TOTP

NOTE:

ALLOWANCE SHOULD
BE PROVIDED FOR
DRAW.



NOTES: FLAT TO FLAT DISTANCE MAY BE OBTAINED FROM HYDRO-PRESS MANUAL SECTION.
FOR ADDITIONAL INFORMATION CHECK Q BOOK.

A COMPLETE SET OF PYRALIN TEMPLATES ARE AVAILABLE AT THE LOFT B/P FILES. HOWEVER, THE TEMPLATES SHOULD ONLY HAVE POINTS TRANSFERRED FROM THEM AND NOT BE SCRIBED AROUND AS THE SCRIBE WILL MAR THE PYRALIN AND RENDER THE TOOL UNUSABLE.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

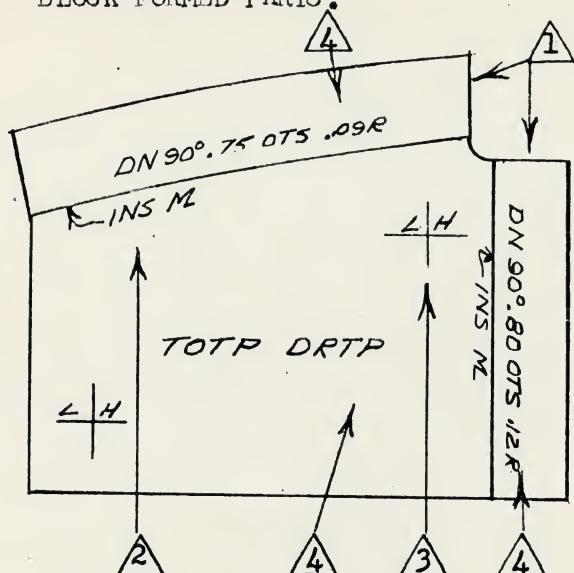
MARK TEMPLATE - STRAIGHT BEAD APPLICATION

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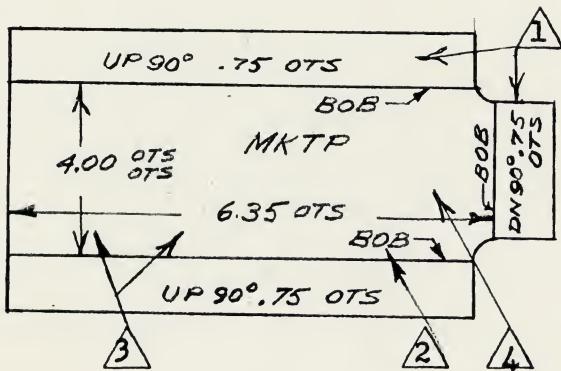
PAGE 26

INFORMATION TO BE SHOWN ON TEMPLATES: SHALL SHOW ALL INFORMATION REQUIRED FOR THE FABRICATION OF TOOLS AND BLANKED PARTS, AND INSPECTION OF COMPLETED BLOCK FORMED PARTS.

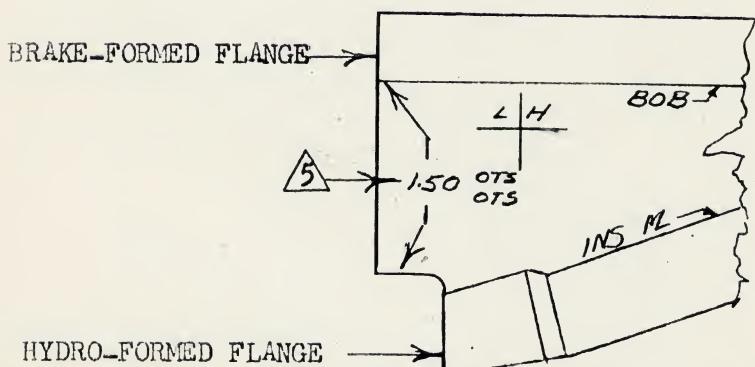


- 1 FLANGE CALLOUTS SHALL APPEAR ON DEVELOPED FLANGES.
- 2 INSIDE MOLD LINE SHALL BE SHOWN AND LABELLED
- 3 LOCATING HOLES SHALL BE POSITIONED SO AS TO FOOL PROOF PLACEMENT OF BLANKED PART ON FORM BLOCK.
- 4 BEND RADII SHALL APPEAR AS PART OF TOOL CALLOUT EXCEPT WHEN SAME RADII DOES NOT APPLY TO ENTIRE PART (SUCH AS ON EXAMPLE SHOWN).

INFORMATION TO BE SHOWN ON TEMPLATES: SHALL SHOW ALL INFORMATION REQUIRED FOR THE FABRICATION OF TOOLS AND INSPECTION OF COMPLETED BRAKE FORMED PARTS.



- 1 FLANGE CALLOUTS SHALL APPEAR ON DEVELOPED FLANGES.
- 2 BOB LINES SHALL BE SHOWN AND LABELLED.
- 3 OUTSIDE DIMENSIONS OF BODY PLANE OF PART SHALL BE DIMENSIONED AS SHOWN.
- 4 BEND RADII SHALL APPEAR AS PART OF TOOL CALLOUT EXCEPT WHEN SAME RADII DOES NOT APPLY TO ENTIRE PART.



- 5 PARTS HAVING ANY BRAKE FORMED FLANGES SHALL SHOW THE DIMENSIONS RELATED TO BRAKE FORMED FLANGE.

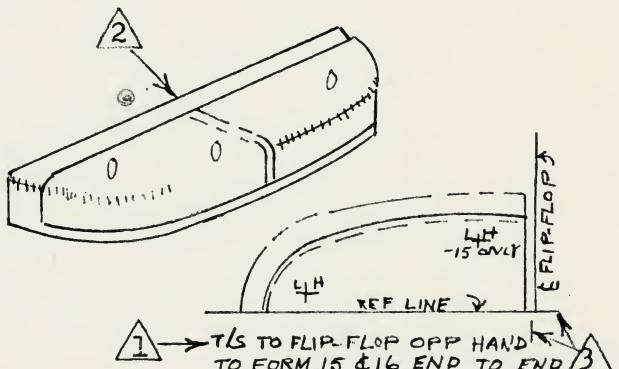
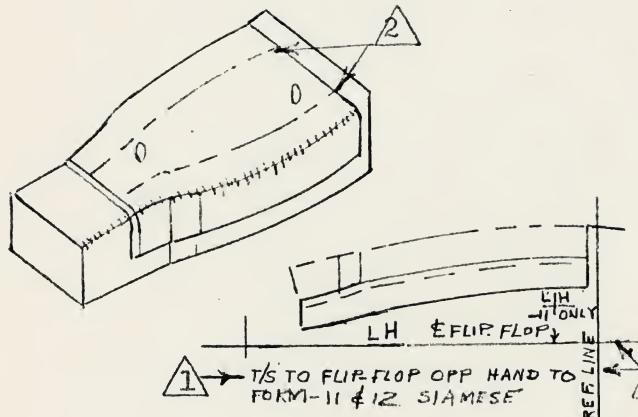
DRAWN	CAME 10-22-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

INFORMATION TO BE SHOWN ON TEMPLATES

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TOOL FABRICATION
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MULTIPLE FORMING: TEMPLATES FOR PARTS FORMED IN MULTIPLE QUANTITIES SHALL INDICATE QUANTITY TO BE MADE. LOFT SHOWS ONLY ONE DETAIL DEVELOPED IN ASSEMBLED POSITION, WITH INFORMATION AND REFERENCE LINES BEING PROVIDED TO ENABLE MULTIPLE TEMPLATE TO BE FABRICATED FROM SINGULARLY SHOWN PART.



① NOTED ON LOFT LAYOUT.

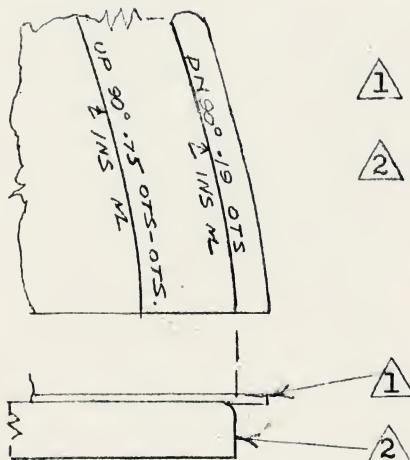
② TRIMMED AFTER FORMING
SIAMESE FORMING

③ PROVIDE REFERENCE SYSTEM FOR
TEMPLATE FABRICATION

END-TO-END FORMING

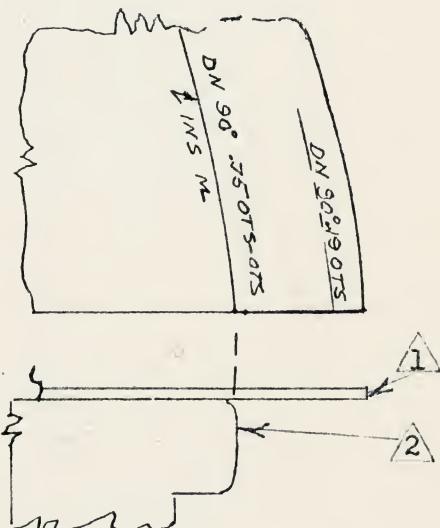
BLOCK FORMED RETURN FLANGES: WHEN THE RETURN FLANGE ON A BLOCK FORMED PART IS USED AS FORM BLOCK LINE, IT SHALL BE SHOWN AND LABELLED AS INSIDE MOLD LINE.

WHEN THE RETURN FLANGE ON A BLOCK FORMED PART IS NOT USED FOR BLOCK LINE, A PARTIAL LINE ADJACENT TO RETURN FLANGE CALLOUT SHALL BE SHOWN.



① BLANKED MATERIAL

② FORM BLOCK



DRAWN	CANE 10-22-56
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APPROVED	
APPROVED	

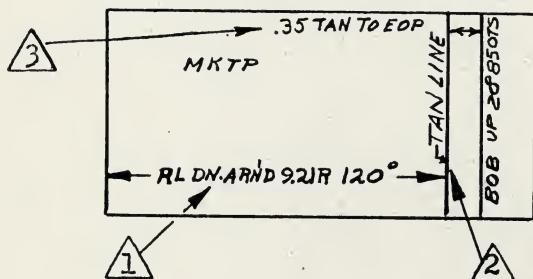
INFORMATION TO BE SHOWN ON TEMPLATES

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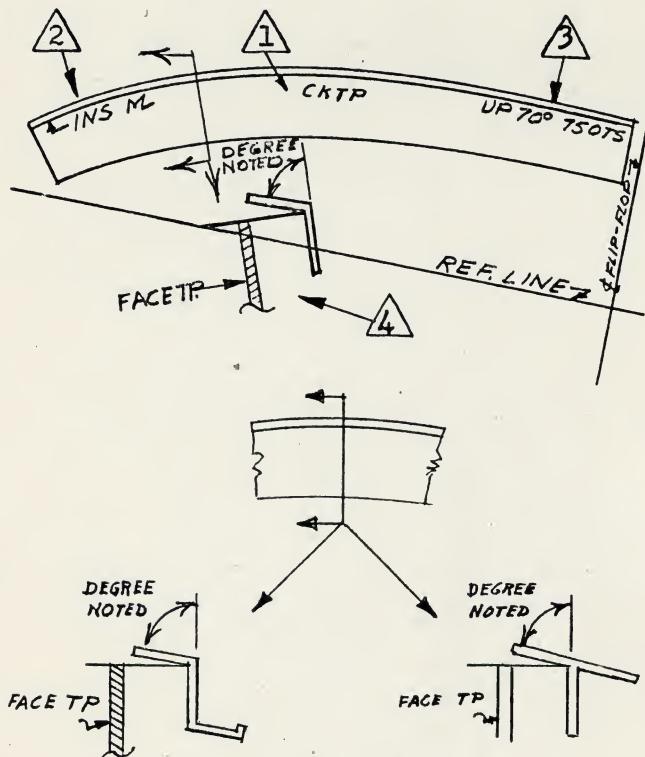
PAGE 32

INFORMATION TO BE SHOWN ON TEMPLATES FOR ROLL-FORMED PARTS: SHALL SHOW ALL INFORMATION REQUIRED FOR THE FABRICATION OF TOOLS AND INSPECTION OF COMPLETED ROLL-FORMED PARTS.



- 1 DIRECTION AND RADIUS OF ROLL SHALL BE CALLED OUT.
- 2 TANGENCIES OF ROLL RADII SHALL BE CALLED OUT.
- 3 DIMENSIONS FROM TANGENCIES TO EOP LINES SHALL BE CALLED OUT.

INFORMATION TO BE SHOWN ON CKTP'S: SHALL SHOW INFORMATION REQUIRED FOR (1) THE FABRICATION OF FORMING TOOLS, (2) TRIMMING AND INSPECTION OF FORMED PARTS.



- 1 TOOL CALLOUT SHALL BE SHOWN ON BODY OF PART
- 2 THE MOLD LINE REQUIRED FOR TOOLING SHALL BE LABELLED.
- 3 DEGREE OF BEND AND FLANGE CALLOUT SHALL BE LABELLED ON THE BODY OF THE PART.
- 4 A SECTION VIEW SHALL BE TAKEN, CLEARLY SHOWING THE PART AND THE MOLD LINE REQUIRED FOR TOOLING. THIS VIEW SHALL ALSO SHOW TEMPLATE APPLICATION AND INDICATE ORIENTATION OF BEVEL ANGLE CALL-OUT.
- 5 TEMPLATE APPLICATION FOR PARTS, SUCH AS TEES AND ZEE'S SHALL SHOW NORMAL BEVEL ANGLE CALLOUT (DO NOT INDICATE AS DEGREES OPENED OR CLOSED), AND INDICATE ORIENTATION OF BEVEL ANGLE CALLOUT.

CKTP'S FOR END-TO-END FORMING: WHEN PARTS ARE TO BE FORMED END-TO-END, ONLY ONE PART NEED BE SHOWN. COMPLETE INFORMATION SHALL APPEAR ON THE SINGLE PART SHOWN. IF PART APPEARS IN ASSEMBLED VIEW (OR FULL LENGTH MOLD LINE FOR ENTIRE TEMPLATE IS NOT SHOWN) INFORMATION AND REFERENCE LINES SHALL BE PROVIDED TO ENABLE MULTIPLE TEMPLATE TO BE FABRICATED FROM SINGULAR PART SHOWN ON CKTP.

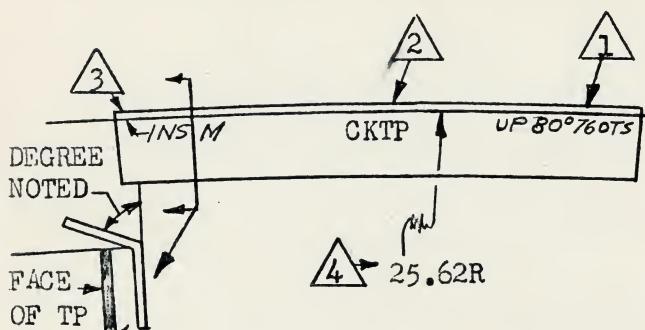
DRAWN	CAME 10-22-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

INFORMATION TO BE SHOWN ON TEMPLATES

TOOL FABRICATION
PROCEDURES
MANUAL

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CKTP'S FOR MULTIPLE-FORMED PARTS (MADE ON STFM OR WPFM) HAVING RADIAL MOLD LINE AND CONSTANT BEVEL ANGLE: WHEN PARTS BEING FORMED END-TO-END HAVE A RADIAL MOLD LINE AND A CONSTANT BEVEL ANGLE, ONLY ONE PART SHALL BE SHOWN, AND IN ADDITION TO NORMAL CKTP INFORMATION SHALL INDICATE THE MOLD LINE RADIUS.



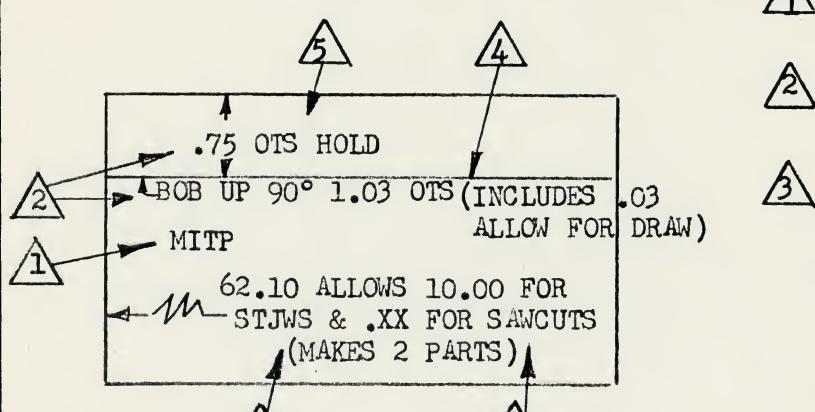
1 CONSTANT BEVEL ANGLE.

2 NORMAL CKTP CALLOUT.

3 MOLD LINE REQUIRED FOR TOOLING.

4 SHOW THIS CALLOUT.

INFORMATION TO BE SHOWN ON MITPS: MITP'S SHALL BE MADE TO A MINIMUM OF 10.00 LENGTH EXCEPT WHERE IMPRACTICAL. FOR PARTS TO BE STRETCHED OR WIPER-FORMED, THE MITP IN ADDITION TO NORMAL TOOL CALLOUT SHALL SHOW (1) LENGTH CALLOUT INDICATING QUANTITY OF PARTS PROVIDED FOR, AND ALLOWANCES FOR SAWCUTS AND STJW'S, (2) MATERIAL ADDED FOR DRAW, AND (3) CALLOUT INDICATION OF FLANGE DIMENSION REQUIRED TO BE HELD TO PROPERLY BUTT WITH THE BACKING STRIP OF STFM OR WPFM.



1 NORMAL TOOL CALLOUT

2 NORMAL "BOB" FORMING INFORMATION

3 LENGTH OF BLANKED MATERIAL SHALL BE DIMENSIONED AS SHOWN AND CALLOUT SHALL INCLUDE ALLOWANCE MADE FOR STJW'S, SAWCUTS, ETC. STANDARD ALLOWANCE FOR STJW'S IS 5.00 FOR EACH END, CONTOUR ROLLED AND WIPER FORMED PARTS REQUIRE A MINIMUM OF 6.00 FLAT EACH SIDE OF CONTOURED AREA.

4 ALLOWANCE FOR MATERIAL DRAW SHALL BE INCLUDED IN THE DEVELOPMENT OF LEG REQUIRING ADDITIONAL MATERIAL, AND BE INDICATED AS SHOWN.

5 CALLOUT FOR THE FLANGE BUTTING THE BACKING STRIP SHALL BE NOTED AS A "HOLD" DIMENSION.

6 INDICATE NUMBER OF PARTS PROVIDED FOR WHEN USED FOR MULTIPLE FORMING.

DRAWN	CAME 10-22-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

INFORMATION TO BE SHOWN ON TEMPLATES

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VARYING FLANGE DEVELOPMENT FOR MITP'S: ON PARTS HAVING A CONSTANTLY VARYING BEVEL ANGLE (IN ONE DIRECTION, NOT REVERSING) MITP'S SHALL BE DEVELOPED TO PROVIDE THIS VARIANCE PER THE FOLLOWING METHODS:

METHOD 1: WHEN FLAT PATTERN DEVELOPMENT AT EACH END OF PART DIFFERS BY .05 OR MORE, THE MITP SHALL BE MADE TO THE EXACT FLAT PATTERN DEVELOPMENT AT EACH EOP. THE RESULTANT BEVEL ANGLE CALLOUT AND FLANGE DEVELOPMENT AT EACH END OF MITP (.05 BEYOND ACTUAL EOP) MUST BE PROPORTIONED TO ASSURE CORRECT BEVEL ANGLE AND FLANGE DIMENSIONS AT ACTUAL PART EOP'S.

METHOD 2: WHEN FLAT PATTERN DEVELOPMENT AT EACH END OF PART DIFFERS BY LESS THAN .05, THE ENTIRE MITP SHALL BE DEVELOPED TO THE LARGEST FLAT PATTERN DEVELOPMENT AND SHALL CALL OUT THE PROPORTIONED DEGREES EXISTING AT END OF MITP (.05 BEYOND PART EOP).

METHOD 3: WHEN VARYING BEVEL ANGLES RESULT IN AN IRREGULAR FLAT PATTERN DEVELOPMENT THAT VARIES OVER .03 FROM A STRAIGHT LINE, THE DEVELOPMENT SHOULD BE MADE OVERRSIZE AND PART TRIMMED AFTER FORMING.

EXAMPLE FOR METHOD 1: PART 30.0 LONG, 1.00 FLANGES, .051 STOCK WITH .12R., 85° BEVEL ANGLE AT ONE END, AND 115° AT OTHER.

1 FLAT PATTERN OF PART.

2 LENGTH OF PART

3 LENGTH OF STOCK TO BE MADE PER MITP

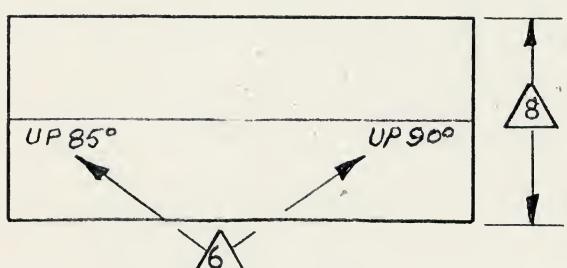
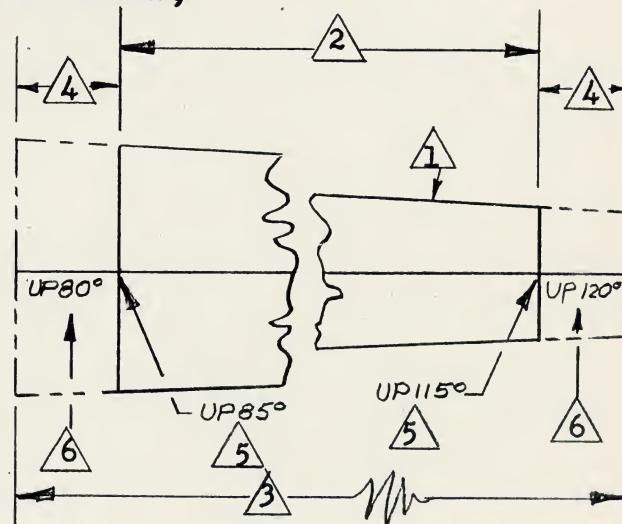
4 MATERIAL ALLOWED FOR STJW'S (5.00 EACH END).

5 ACTUAL BEVEL ANGLE AT EOP.

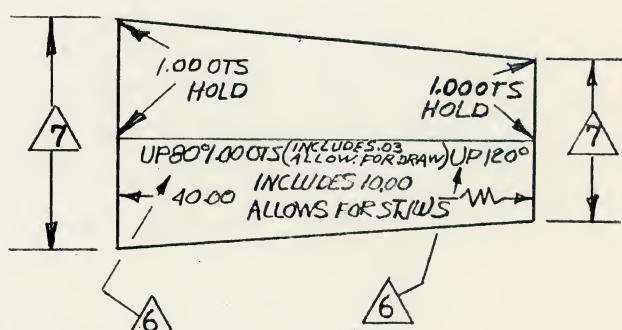
6 PROPORTIONED BEVEL ANGLE AT END OF MITP.

7 PROPORTIONED DEVELOPMENT AT END OF MITP

8 DEVELOPMENT TO LARGEST AMOUNT



METHOD 2



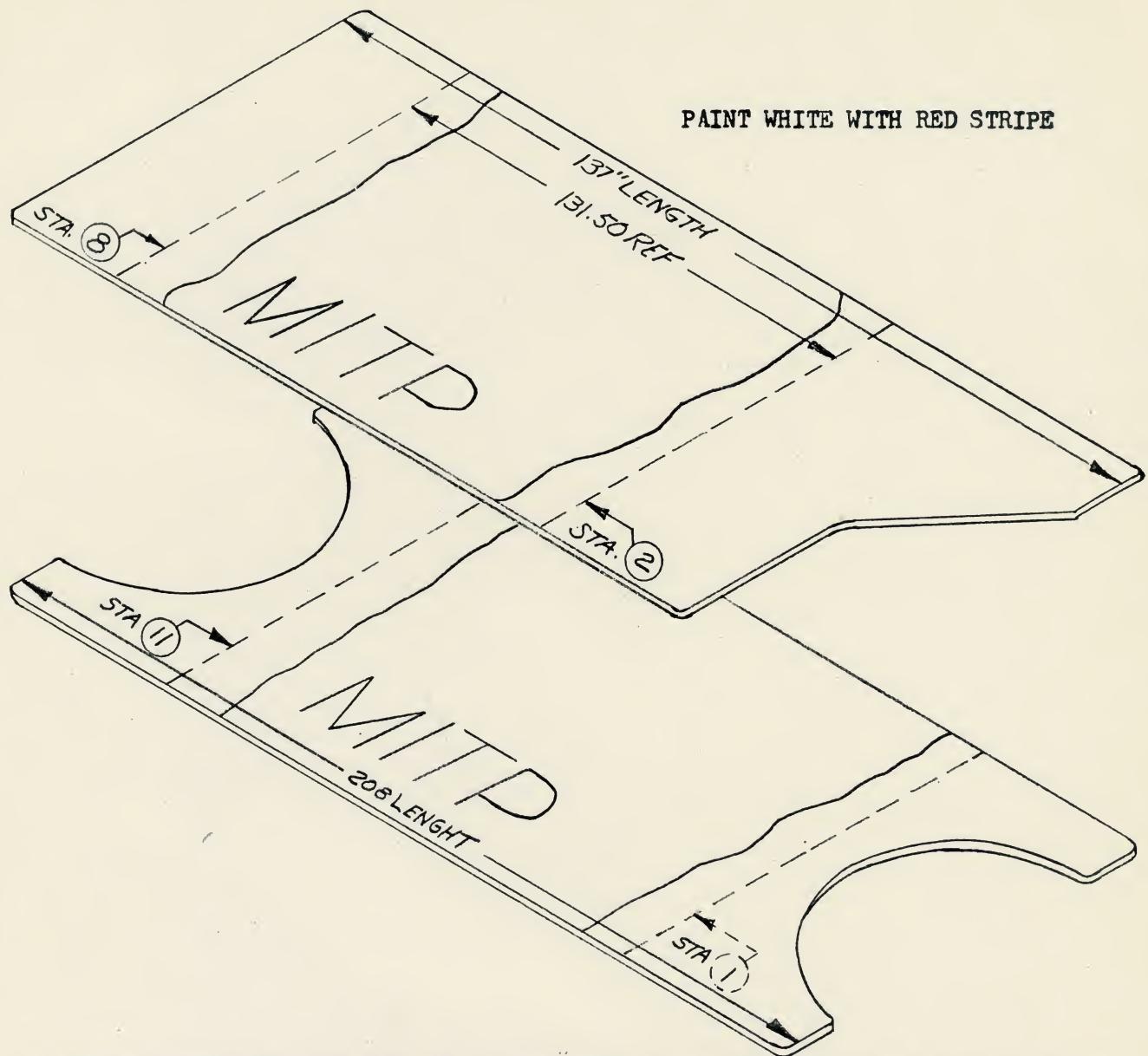
METHOD 1

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APPROVED	

VARYING FLANGE DEVELOPMENT FOR MITP'S

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TOOL FABRICATION PROCEDURES MANUAL



MINIATURE TEMPLATES ARE USED IN CASES WHERE PARTS ARE ESPECIALLY LARGE OR LONG AND ALL NECESSARY INFORMATION CAN BE GIVEN WITHOUT LAYOUT OF ENTIRE SIZE. - EXAMPLES ARE SHOWN.

TEMPLATES ARE USUALLY MADE TRUE WIDTH WITH A FORESHORTENED LENGTH; HOWEVER THEY MAY BE MADE WITH WIDTH AND LENGTH FORESHORTENED FOR SQUARE-SHEARED PARTS.

STENCIL MITP OR RUBBER STAMP MITP 2" LETTERS ON FACE OF TEMPLATE.

MAKE FROM TEMPLATE STOCK (#18 GAGE STEEL)

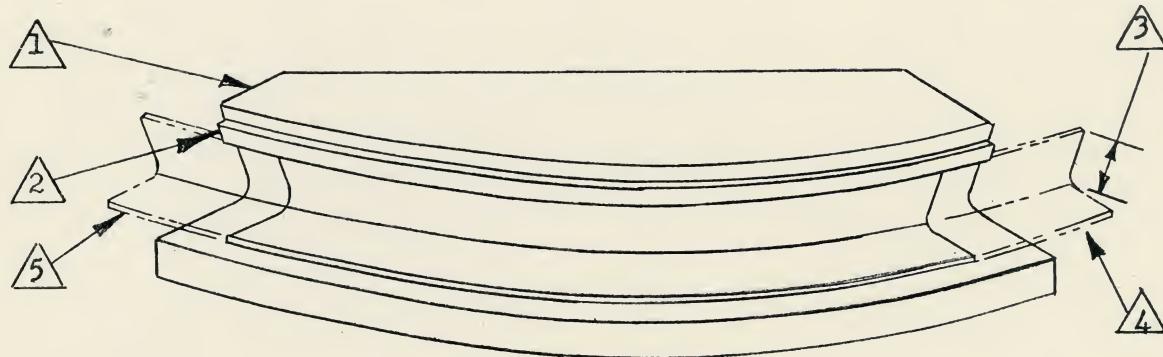
DRAWN	CAME 10-26-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

MINIATURE TEMPLATE "MITP"
TOOL ILLUSTRATIONS

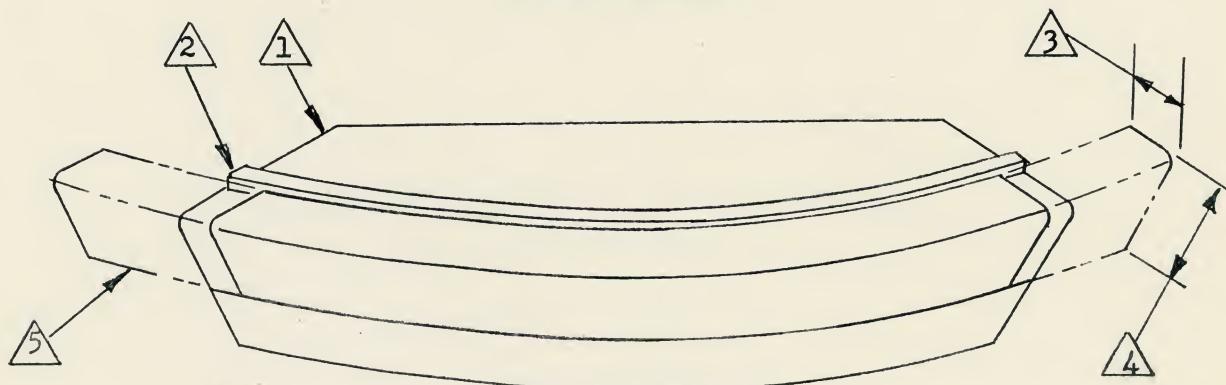
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ALLOWANCES FOR MATERIAL DRAW ON MITP'S: ON "LEG-OUT" STRETCH AND WIPER FORMING, THE WIDTH OF THE OUTSTANDING FLANGE WILL BE REDUCED DUE TO MATERIAL DRAW, AS WILL ALSO BE THE DOWN FLANGE ON "LEG-IN" FORMING.



LEG OUT FORMING



LEG IN FORMING

- 1) STFM
- 2) BACK-UP STRIP
- 3) "HOLD" FLANGE

- 4) DRAW TO BE ADDED
- 5) 5.00 ALLOW FOR STJWS EACH END

ALLOWANCES FOR MATERIAL DRAW ON STRETCH-FORMED OR WIPER FORMED PARTS MADE FROM FLAT STOCK: SHALL BE INCLUDED IN FLANGE DEVELOPMENTS.

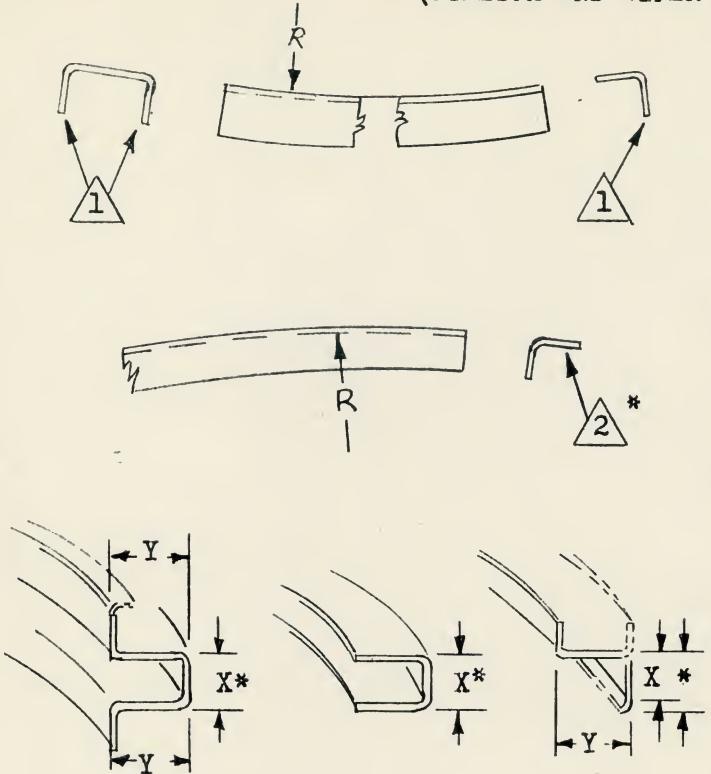
DRAWN	CAME 10-22-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

"ALLOWANCES FOR MATERIAL DRAW ON MITP'S"

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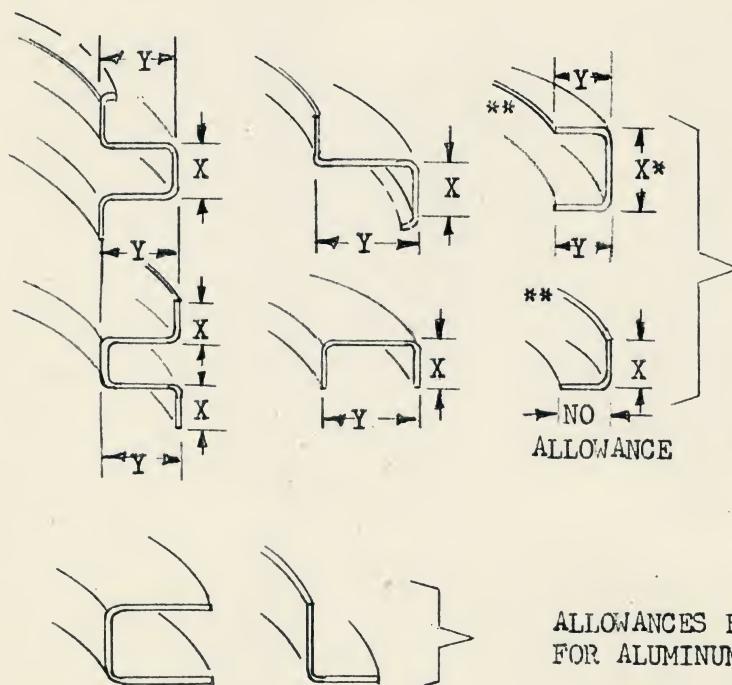
TOOL FABRICATION PROCEDURES MANUAL
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ALLOWANCES FOR DRAW - ALUMINUM & MAGNESIUM
(STRETCH AND WIPER FORMED PARTS)



- 1 ON "LEG-OUT" ANGLES ADD .06 PER 1.00 OF FLANGE DIMENSION ON PARTS MADE FROM .072 OR LESS WHEN R IS UP TO 30.00 - WHEN R IS 30.00 OR MORE ON ALL GAUGES ADD .03 PER 1.00 FLANGE.
 - 2 ON "LEG-IN" ANGLES ADD .06 ON PARTS MADE FROM .072 OR LESS WHEN R IS UP TO 6.00. WHEN R IS 6.00 OR MORE ON ALL GAUGES ADD .03.
 - 3 WHEN R IS GREATER THAN 8.00 ADD .03 TO "X" AND "Y" FLANGES ON ALL ZEES AND HAT SECTIONS, AND WEB OF CHANNELS.
 - 4 WHEN R IS LESS THAN 8.00, ADD .03 TO "Y" FLANGE. ADD .09 TO "X" FLANGES OF .50 TO .75, AND .12 TO "X" FLANGES GREATER THAN .75.
- * NOTE: NO ALLOWANCE IS REQUIRED FOR WIPER FORMED "LEG-IN" PARTS.

ALLOWANCES FOR DRAW - TITANIUM & STAINLESS STEEL
(STRETCH AND WIPER FORMED PARTS)



TO DETERMINE FLANGE LENGTHS INCLUDING ALLOWANCES FOR DRAW, (1) MULTIPLY "X" FLANGE DIMENSION BY 1.035 FOR GAUGES UP TO .025 OR BY 1.05 FOR GAUGES .025 AND OVER. (2) MULTIPLY "Y" FLANGE DIMENSION BY 1.018 FOR GAUGES UP TO .025 OR BY 1.025 FOR GAUGES .025 AND OVER.

*NOTE: NO ALLOWANCE REQUIRED TO "X" FLANGE DIMENSION WHEN PART IS WIPER-FORMED.

**NOTE: THESE SHAPES CANNOT BE FORMED BY WIPER IF MADE FROM TITANIUM.

ALLOWANCES FOR DRAW SAME AS SHOWN FOR ALUMINUM & MAGNESIUM

DRAWN	CAME 10-22-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

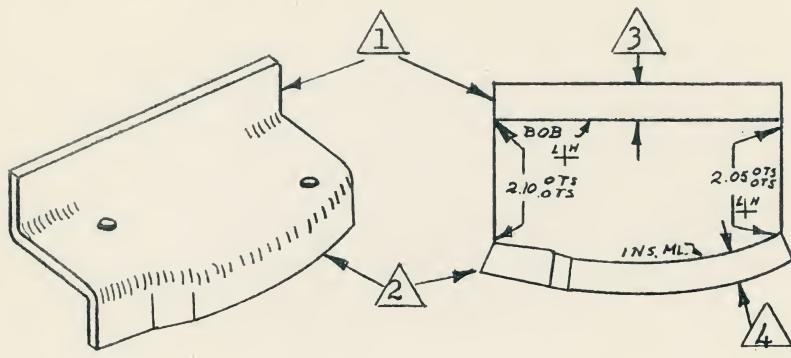
ALLOWANCES FOR DRAW - ALUMINUM & MAGNESIUM
(STRETCH AND WIPER FORMED PARTS)

CONVAIR
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DEVELOPMENT FOR DUAL-TYPE FORMING: COMBINING BOB AND BLOCK FORMING OPERATIONS
REQUIRES A COMBINATION OF BOTH TYPES OF DEVELOPMENT.

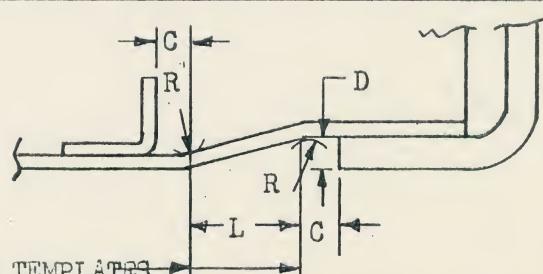


- 1 BRAKE FORMED FLANGE
- 2 BLOCK FORMED FLANGE
- 3 REFER TO "FLAT PATTERN DEVELOPMENT FOR BEND ON BRAKE"
- 4 REFER TO "FLAT PATTERN DEVELOPMENT FOR BLOCK FORMED PARTS"

STANDARD JOGGLE DATA:

MATERIAL	SHEETS HYDRO-PRESS OR BRAKE BEND			ROLLED (Y) SECTIONS		EXTRUDED (K) SECTIONS	
	SOFT OR ANNEALED AL	HEAT-TREATED OR COLD-WORKED AL					
	3003-0	2024-T4	T1*	2024-T4	7075-T6		
	2024-0	2024-T4 CLAD	MAG*	2024-T3	MAG	ALL	
	5052-0	6061-T4		7075-W		MATL'S	
	7075-0	7075-T6					
		7075-T6 CLAD					
L	3D	4D	4D	4D	6D	6D	
C	.12 (FOR GAGES UP TO & INC. .102) .20 (FOR GAGES .125 TO .188)			.12		.12	

* ALL T1 & MAG VALUES INDICATED ARE HOT FORMED
R = RADII TO BE EQUAL OR GREATER THAN STANDARD BEND RADII FOR GAGE MAT'L USED.



THESE LINES TO BE SHOWN ON TEMPLATES

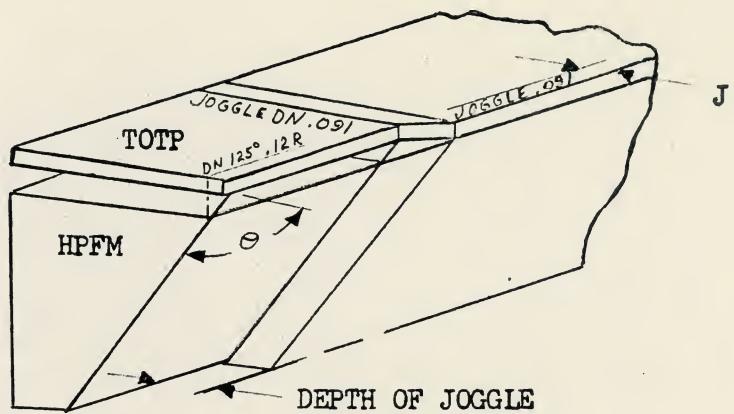
DRAWN	CAME 10-24-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

DEVELOPMENT FOR DUAL TYPE FORMING
& STANDARD JOGGLE DATA

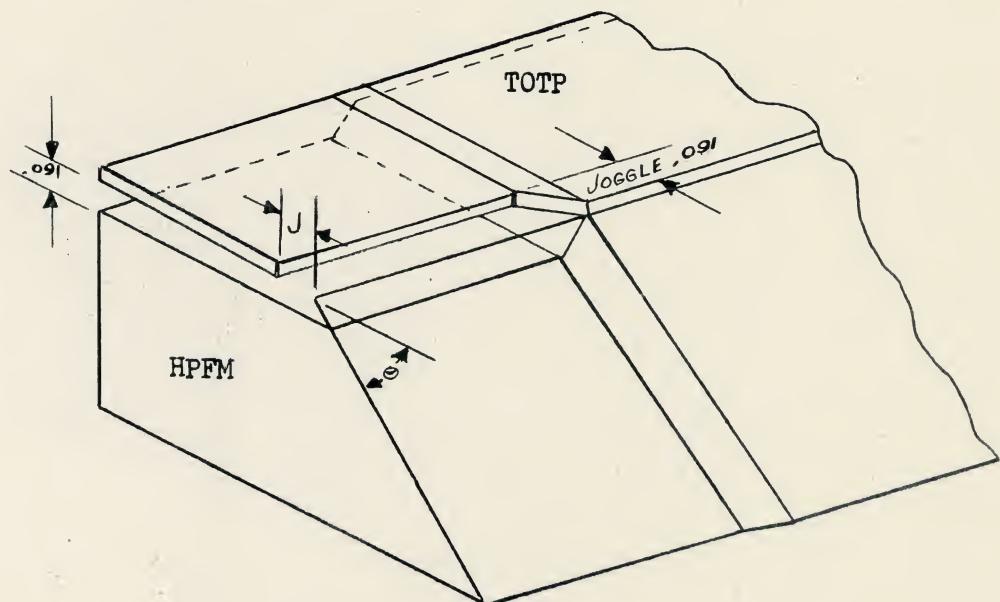
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$$J = SEC. 8 \times DEPTH \text{ OF JOGGLE}$$



$$J = SEC. 8 \times DEPTH \text{ OF JOGGLE}$$

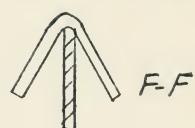
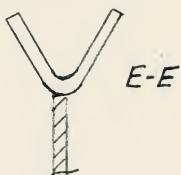
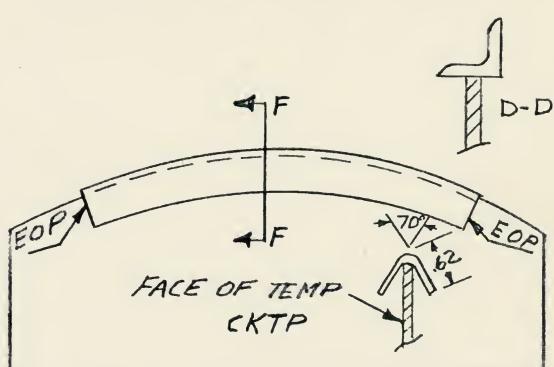
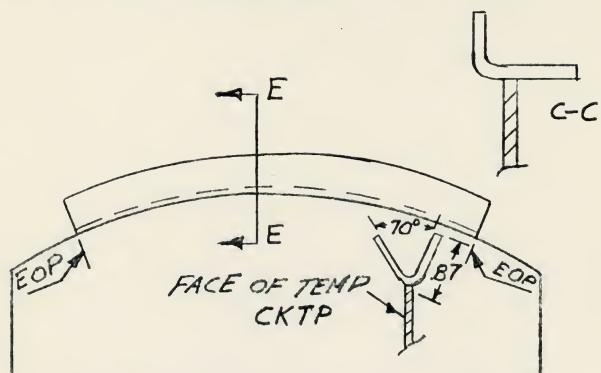
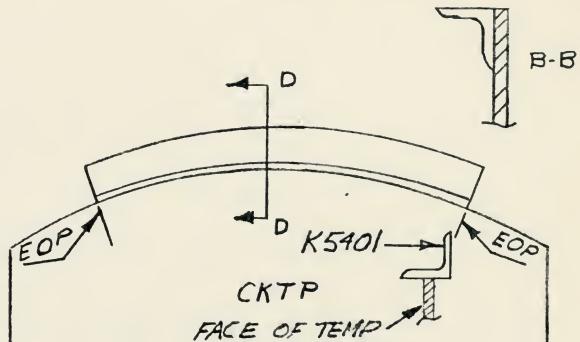
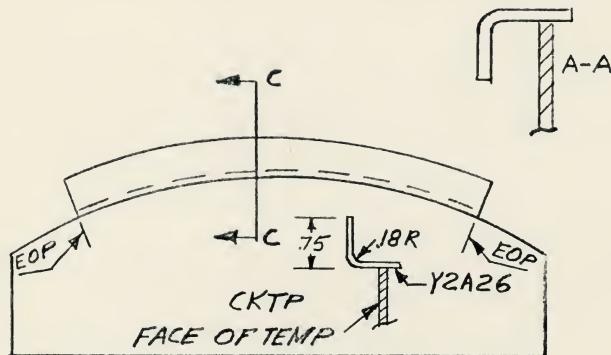
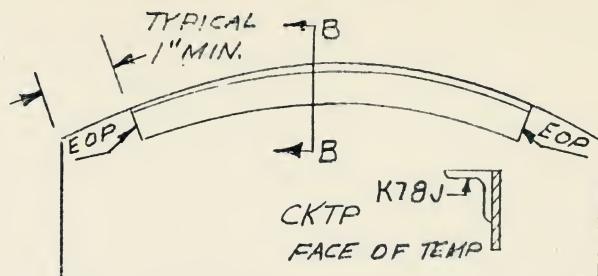
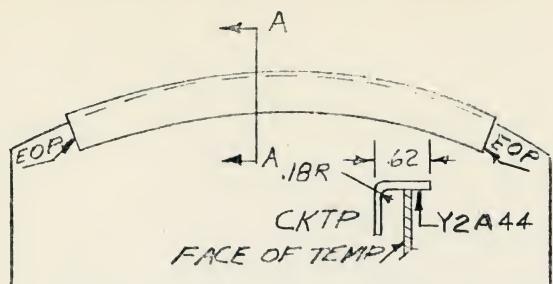
DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

DOUBLE JOGGLES
HYDRO PRESS FORM

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CKTP NOTES:

CKTP'S ARE TO BE MADE MALE UNLESS OTHERWISE SPECIFIED OR PRACTICAL.

THE ANGLE OF THE BEND SHOULD BE CALLED OUT ON CKTP'S.

RADIUS AND FLANGE LENGTH SHOULD BE CALLED OUT ON CKTP'S.

MATERIAL AND GAGE OF SHEET STOCK SHALL BE CALLED OUT ON CKTP
INCLUDING "Y" AND "K" SECTIONS.

A SKETCH IS REQUIRED ON ALL CKTP'S TO SHOW APPLICATION OF TEMPLATE TO PART.
D/C (DRAWING CHANGE)

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

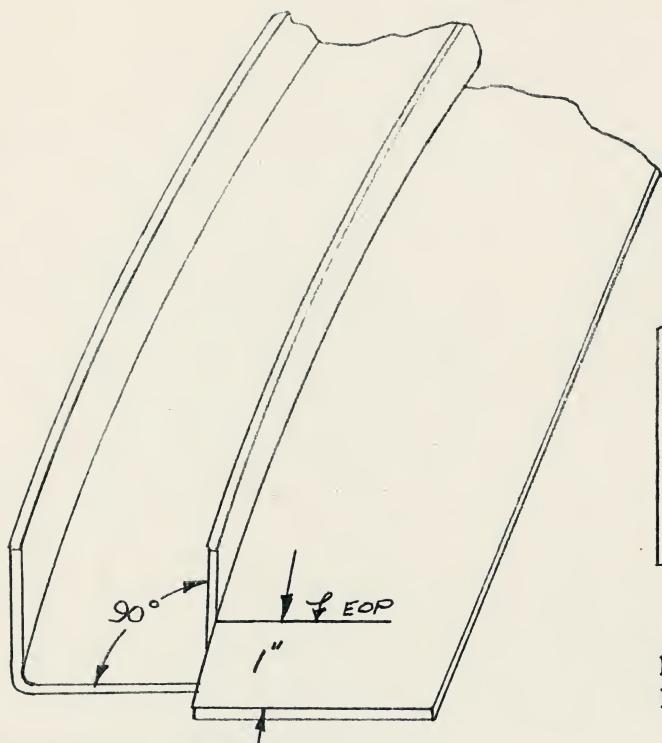
CHECK TEMPLATE "CKTP"
TOOL ILLUSTRATION (MALE ILLUSTRATED)

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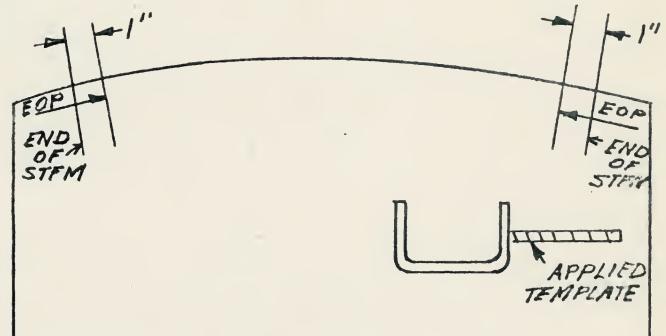
TOOL FABRICATION
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TOOL LOFT PROCEDURE



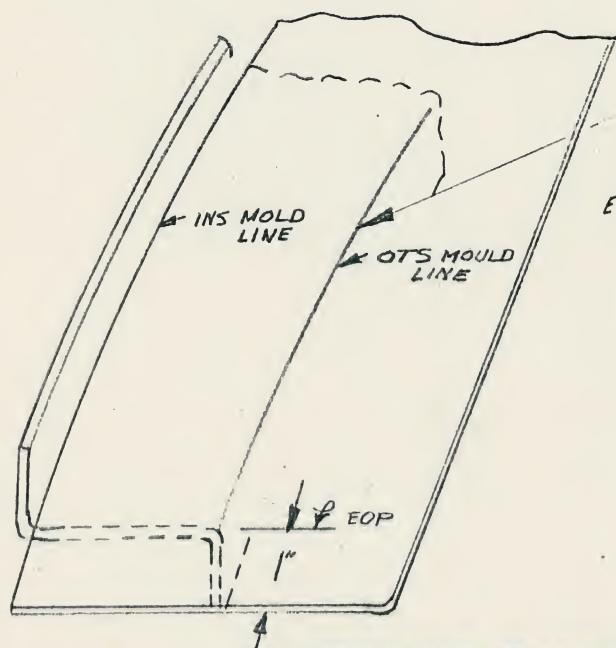
APPLICATION OF TEMPLATE NO. 1



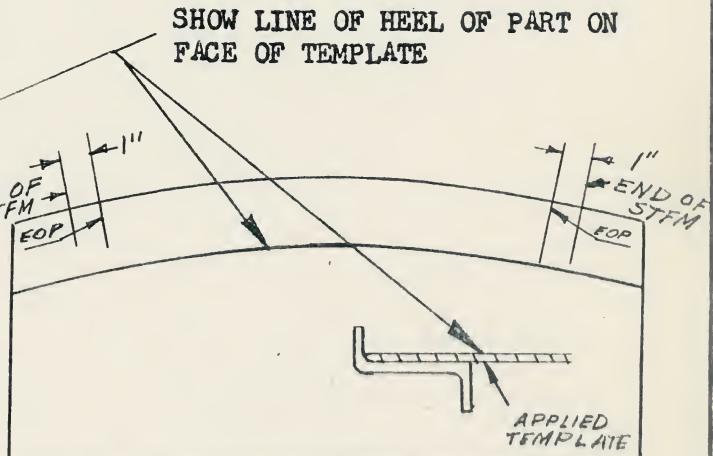
TEMPLATE NO. 1

MAKE CKTP TO APPLY MALE UNLESS OTHERWISE NOTED.

CKTP ALSO USED TO FAB STFM.



APPLICATION OF TEMPLATE NO. 2



TEMPLATE NO. 2

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

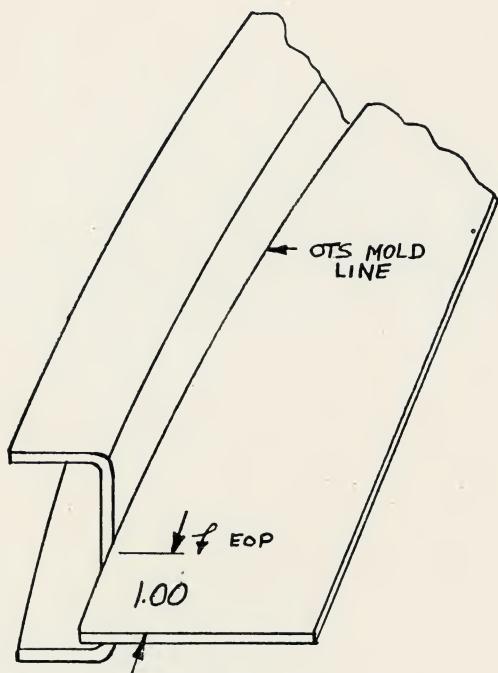
CKTP FOR STRETCHER FORM

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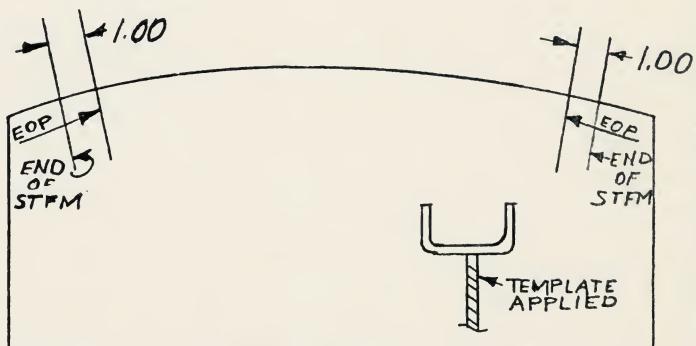
TOOL FABRICATION
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TOOL LOFT PROCEDURE

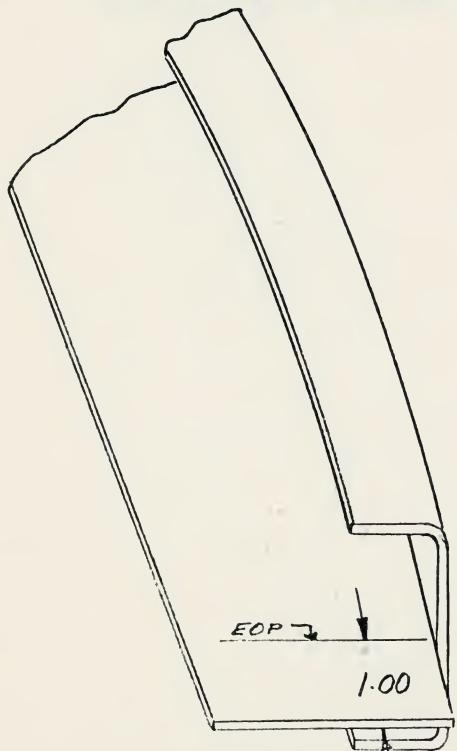


APPLICATION OF TEMPLATE NO. 3

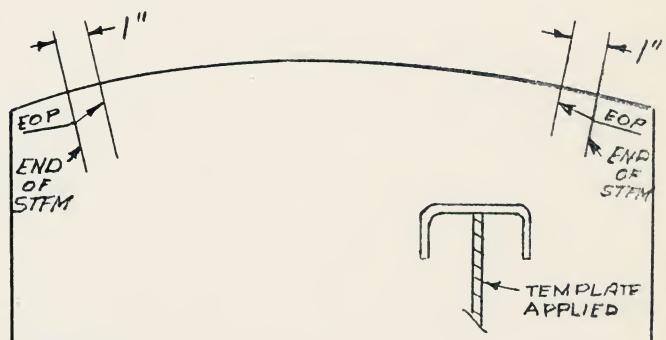


TEMPLATE NO. 3

CKTP ALSO USED TO FABRICATE STEM



APPLICATION OF TEMPLATE NO. 4



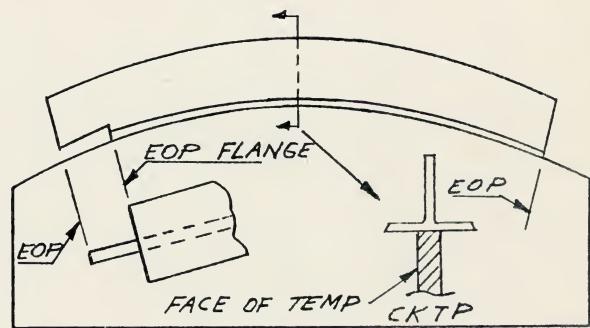
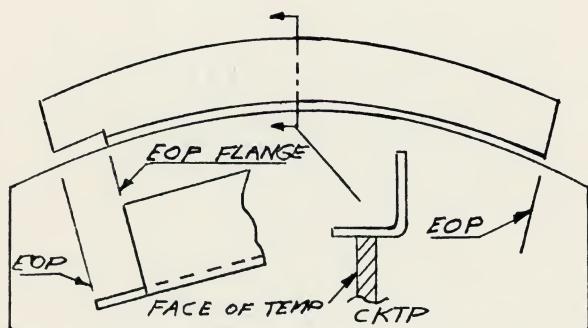
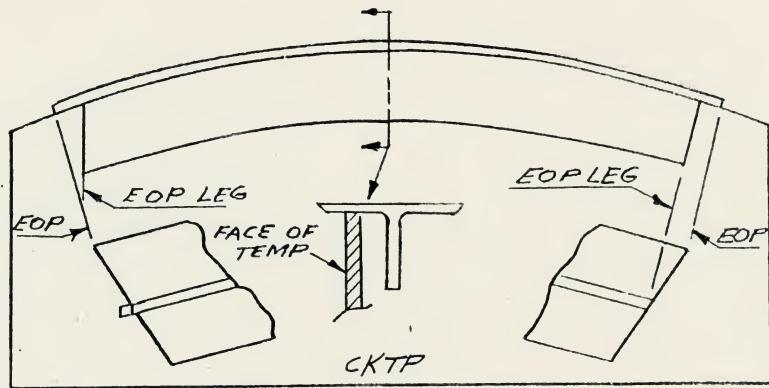
TEMPLATE NO. 4

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

CKTP FOR STRETCHER FORM

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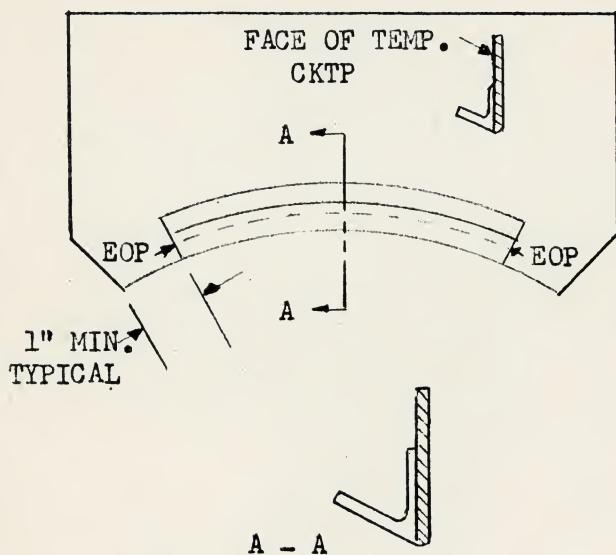
DRAWN	CAM 10-24-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOL ILLUSTRATIONS
CHECK TEMPLATE

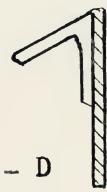
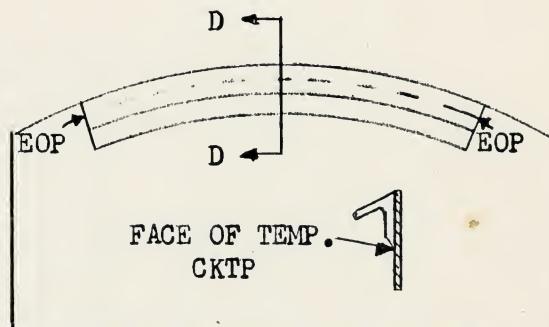
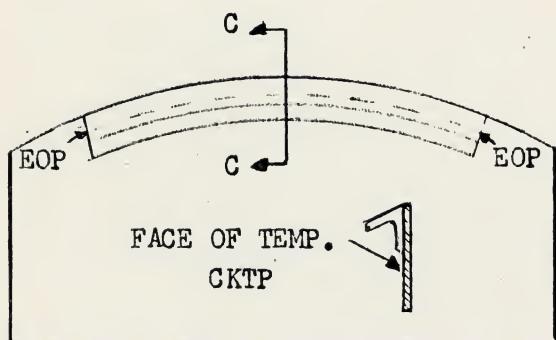
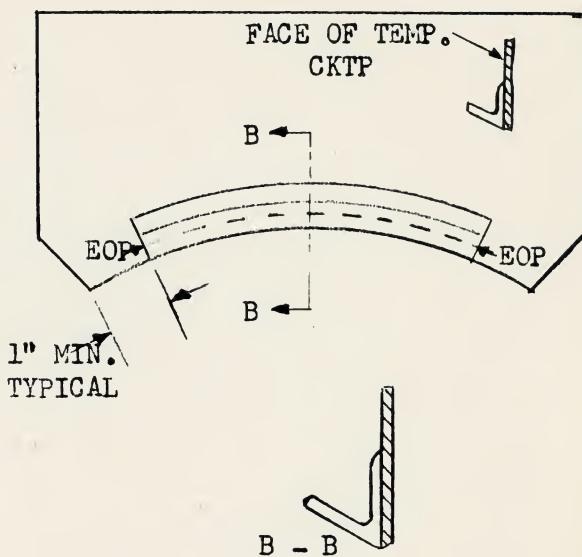
CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
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"Y" SECTIONS



"K" SECTIONS



DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

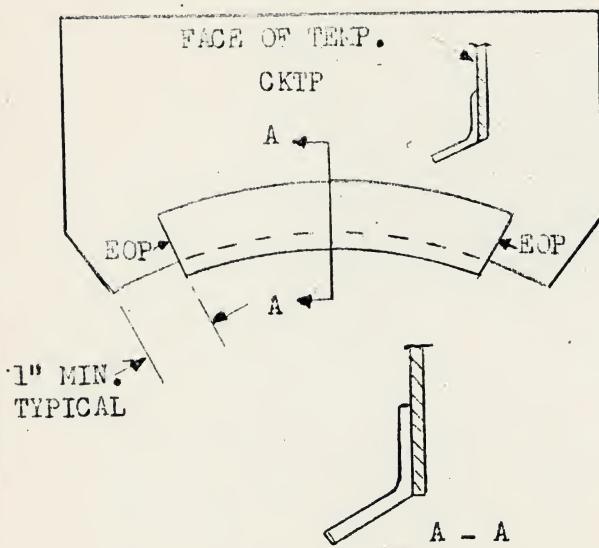
TOOL ILLUSTRATIONS
CHECK TEMPLATE

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
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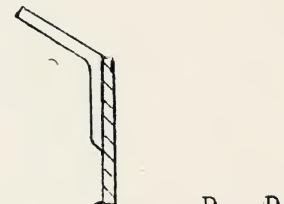
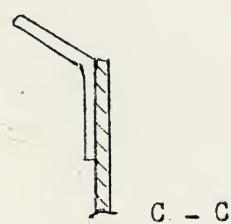
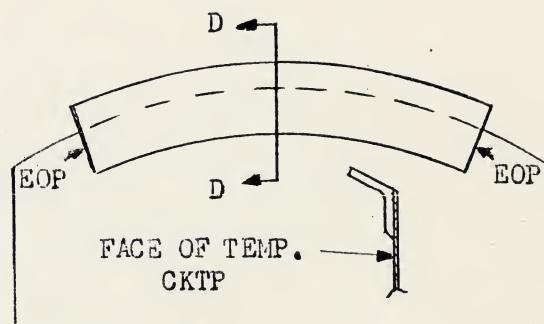
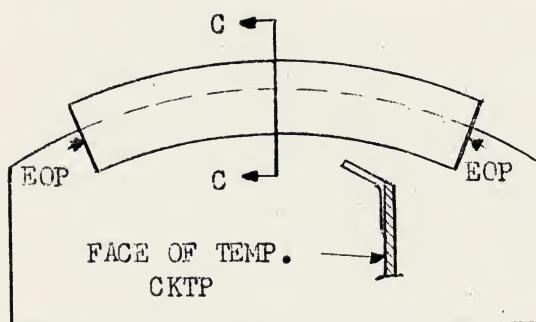
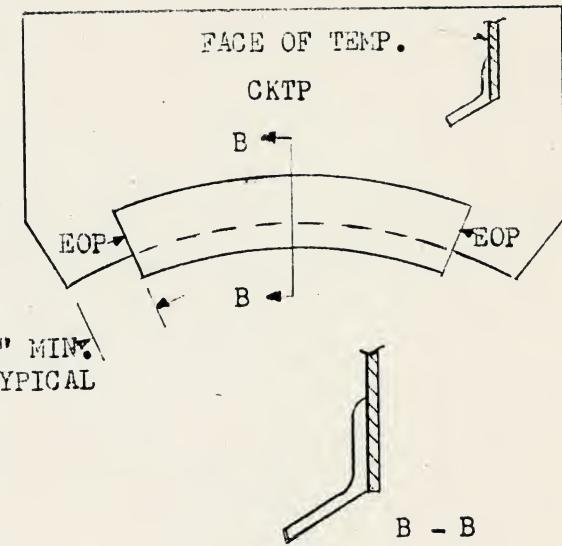
TOOL FABRICATION
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"Y" SECTIONS



"K" SECTIONS



DRAWN	CAME 11-1-46
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

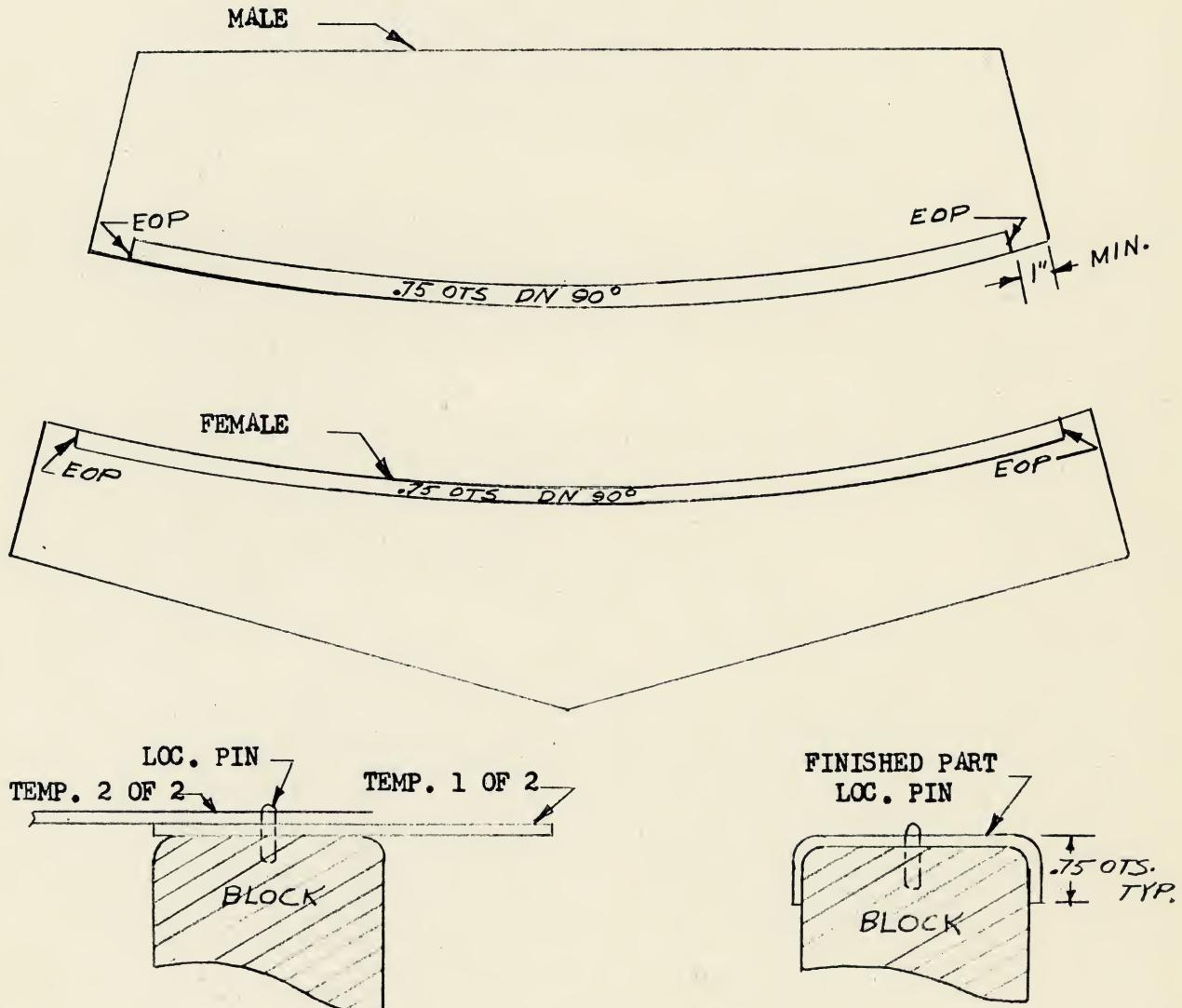
TOOL ILLUSTRATIONS
CHECK TEMPLATES

CONVAIR
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TOOL LOFT PROCEDURE



EXAMPLE OF A TWO PART CKTP USED FOR LONG NARROW MEMBERS. LOCATING HOLES MUST COORDINATE.

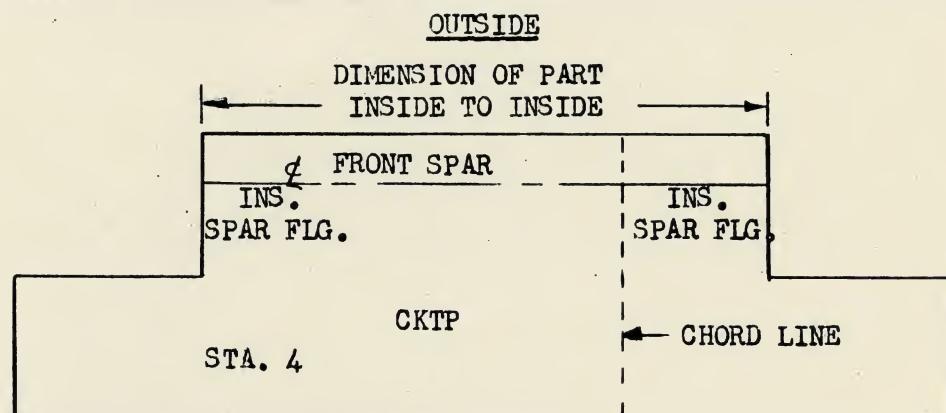
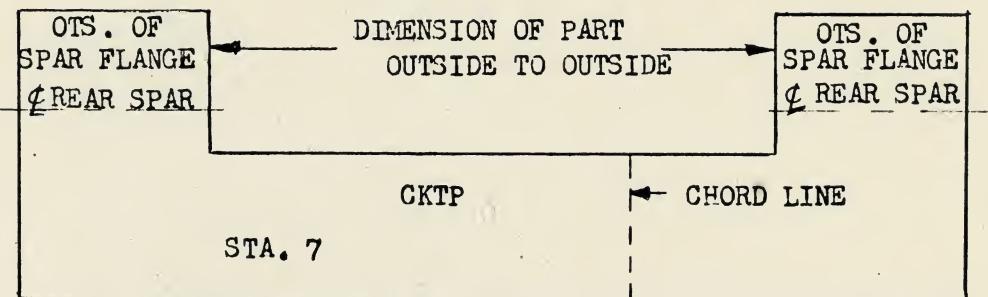
CKTP ALSO USED TO FABRICATE STFM.

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

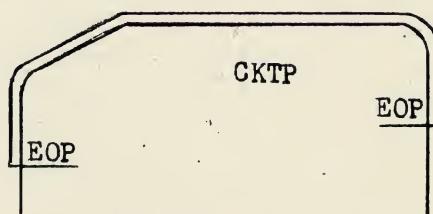
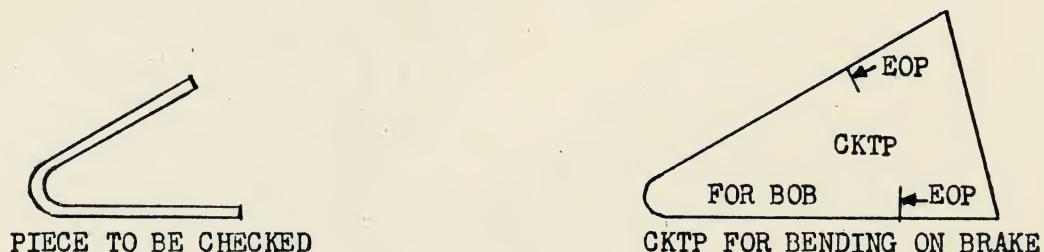
CKTP FOR LONG NARROW MEMBERS

CONVAIR
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OUTSIDE



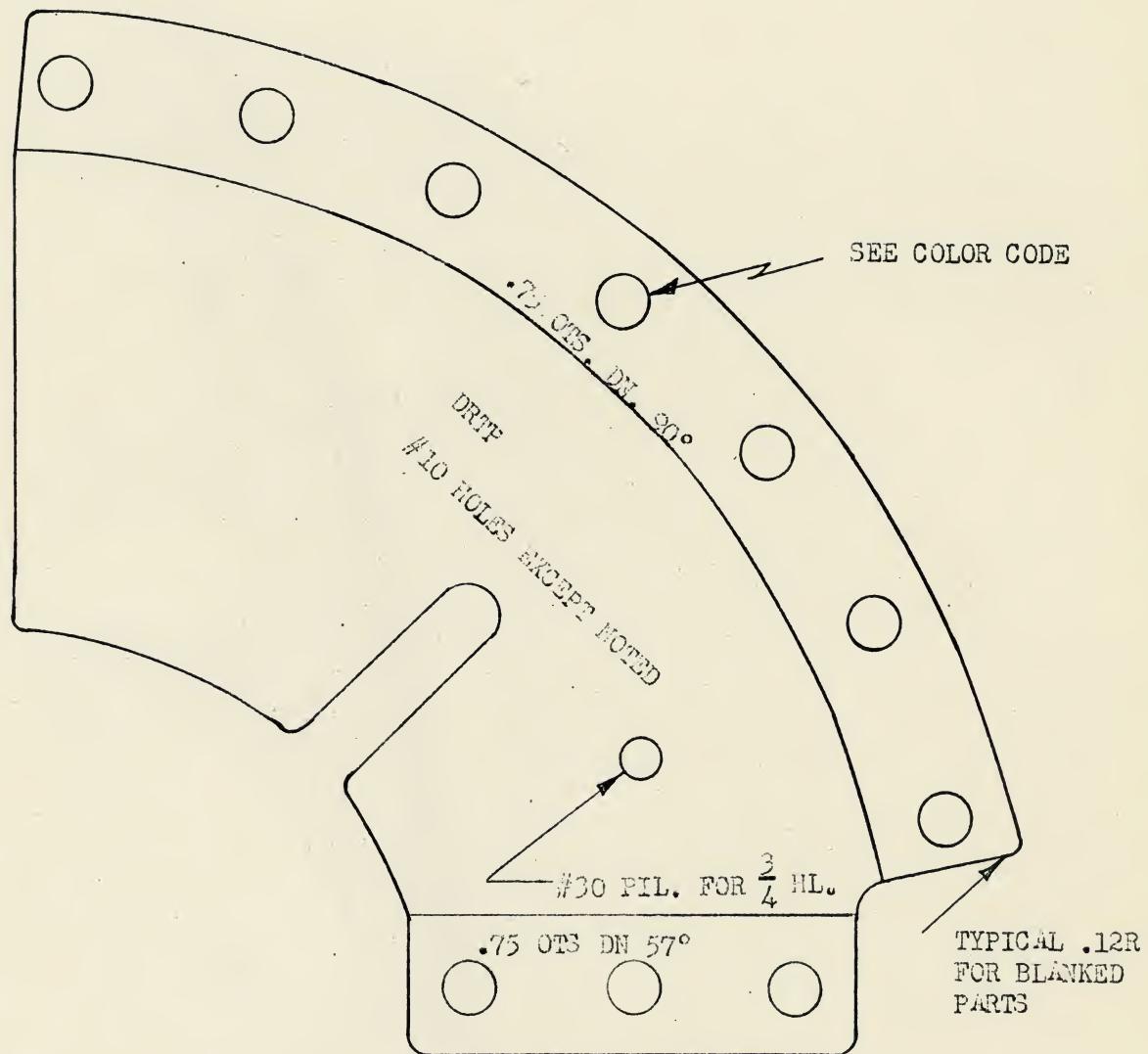
EXAMPLE OF THREE BEND CKTP

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10-56
APPROVED	
APPROVED	

CHECK TEMPLATE
TOOL ILLUSTRATION

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TOOL FABRICATION PROCEDURES MANUAL
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HOLES IN DRILL TEMPLATES ARE ADAPTER SIZE TO ALLOW FOR ADAPTER BUSHINGS (SEE STANDARD HOLE CHART).

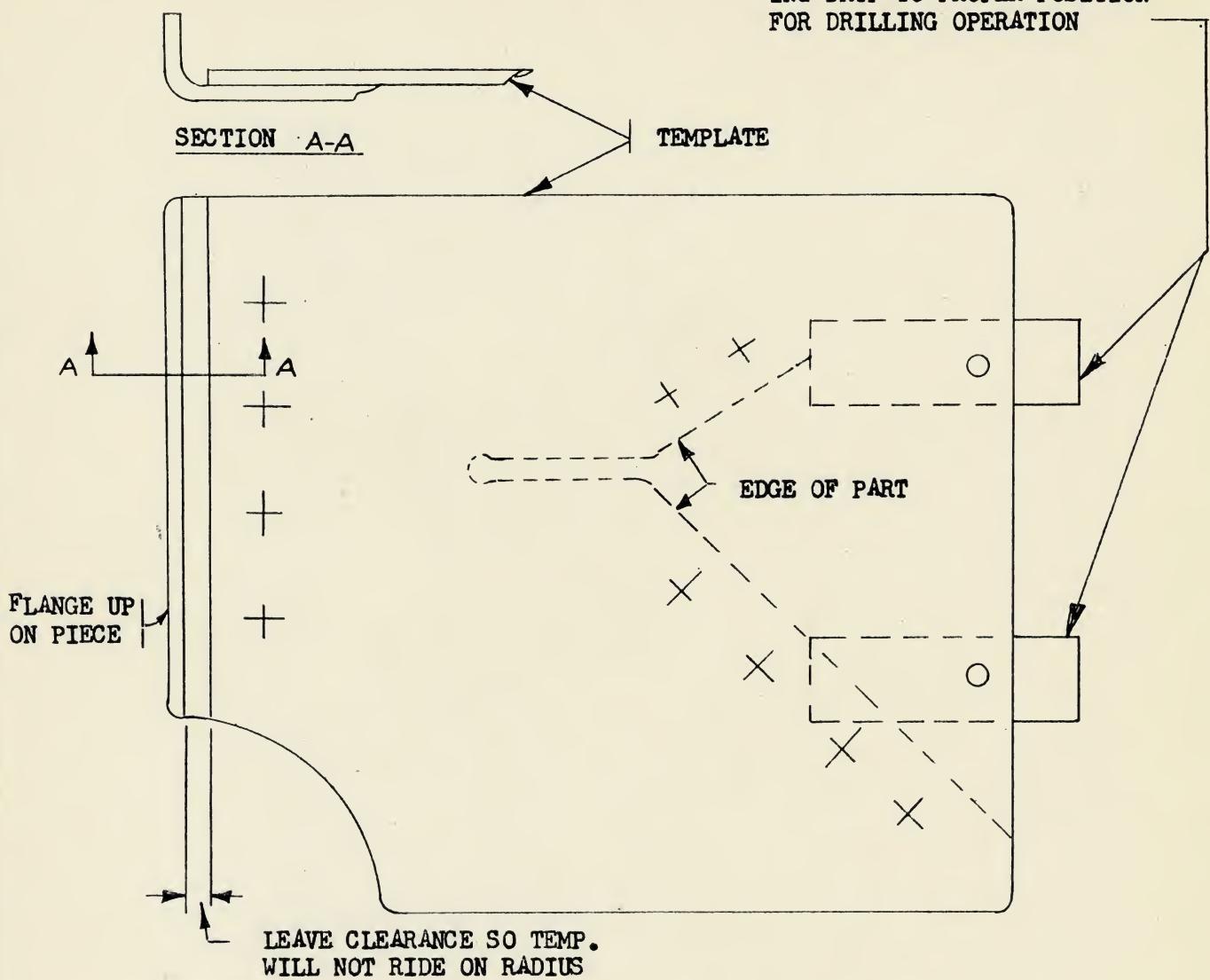
DRAWN	CASE 10-24-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOL ILLUSTRATION - DRILL TEMPLATE

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BLOCKS WITH PINS FOR SECURING DRTP TO PROPER POSITION FOR DRILLING OPERATION



REF. STD. COLOR CODE FOR HOLES

PART TO BE DRILLED AND ASSEMBLED ON ASSEMBLY FIXTURE.

NOTE: WHEN THE WEB TEMPLATE HAS LOCATING HOLES THE DRTP LOCATING HOLES SHOULD BE COORDINATED WITH THEM. DRTP LOCATING HOLES ARE ACTUAL SIZE.

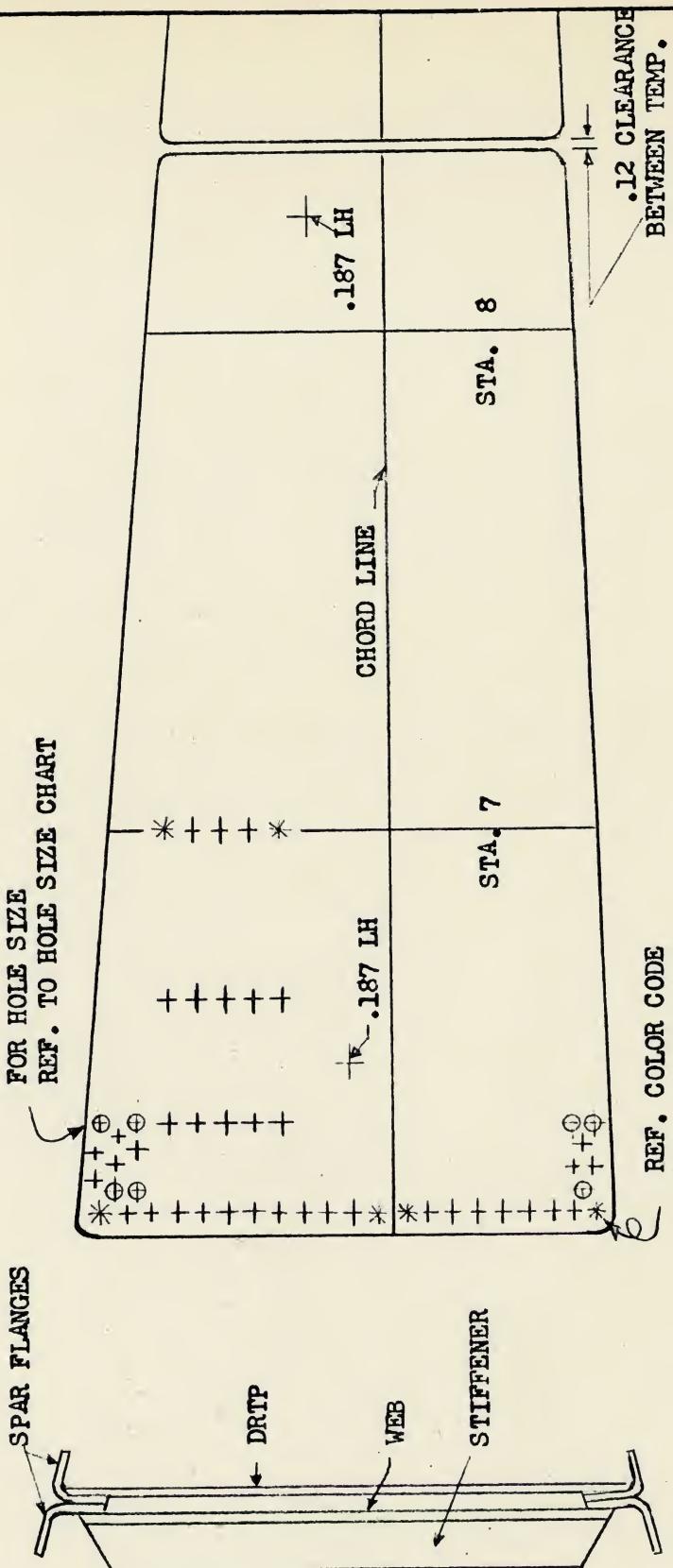
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOL ILL. DRTP FOR ASSEMBLY FIXTURE

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THIS TYPE OF DRTP IS OFTEN USED IN CONJUNCTION WITH ASSY. FIXTURES. THE CHORD LINE IS ALWAYS SHOWN AND STATION CENTER LINE IF NECESSARY. CLEARANCE OF RADII ON SPAR FLANGES IS IMPERATIVE, LOCATING HOLES MUST BE COORDINATED WITH DRTP. RIVET SIZE MAY BE CALLED OUT BY LOFTSMAN AS SHOWN TO AID IN PUNCHING HOLES ACCURATELY. (THIS TEMP. IS PHOTOGRAPHIC REPRODUCTION) MAKE FROM TEMP. STOCK (18 GAU

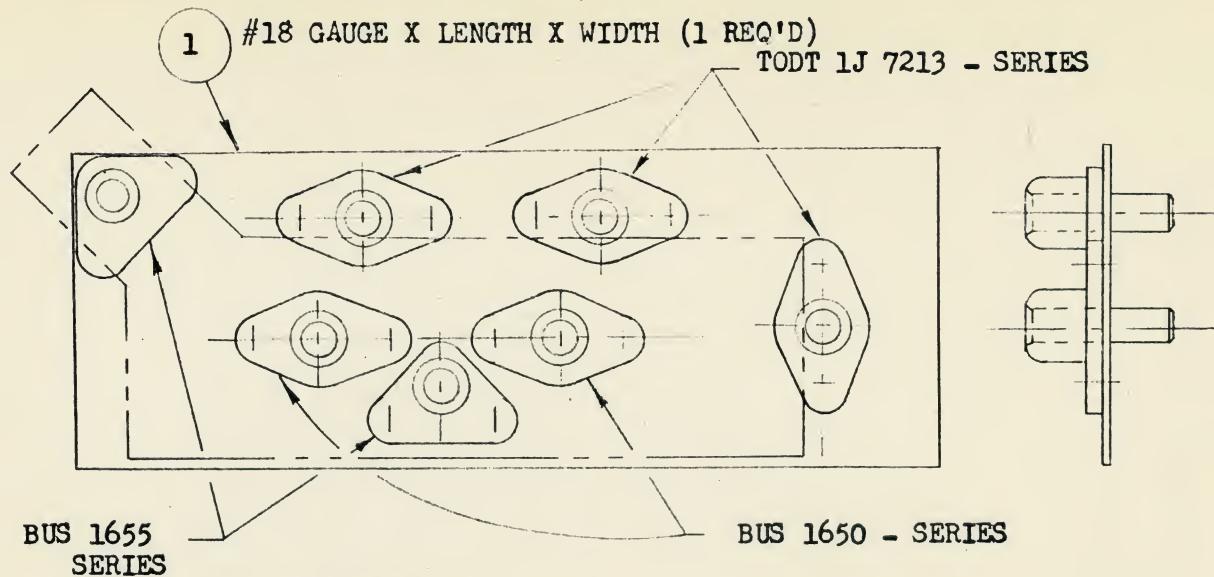
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOL ILL. DRTP FOR DRILLING PARTS ON ASFX

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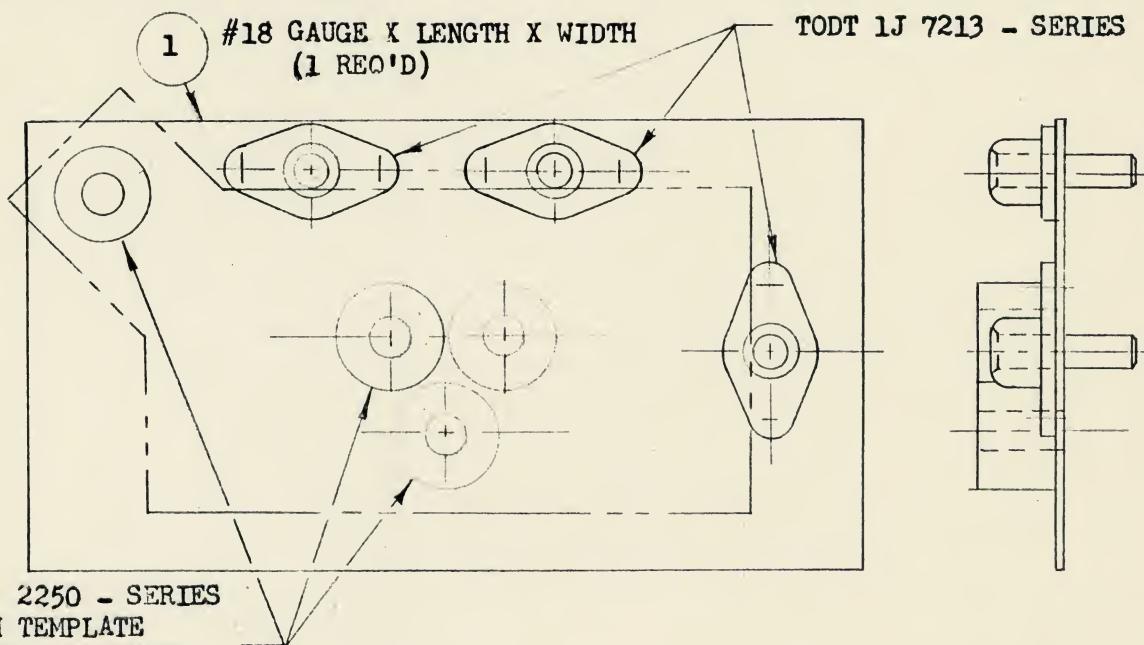
TOOL FABRICATION PROCEDURES MANUAL

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METHOD OF APPLICATION

1. PIERCE HOLES IN #18 GAUGE STEEL (HOLES MUST BE P.F. FOR BUSHINGS) - REF. "D₁" DIM.
2. PRESS IN BUSHINGS AND SPOTWELD OR FLUSH RIVET ANCHOR NUTS TO STEEL SHEET.
3. FOR CONTOUR DRPE'S, FORM TABS ON ANCHOR NUTS TO CONTOUR.
4. SEE FOLLOWING PAGES



BUS 2250 - SERIES
PEM TEMPLATE
DRILL BUSHINGS

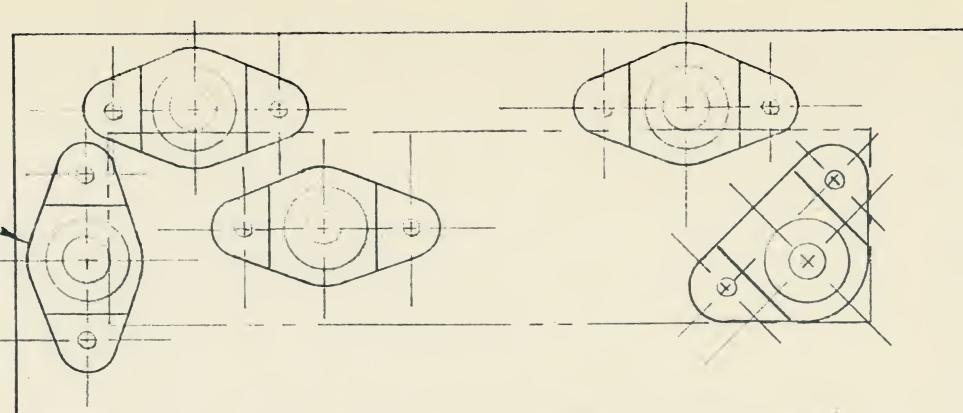
1. PIERCE HOLES IN #18 GAUGE STEEL (HOLES MUST BE P.F. FOR BUSHINGS) - REF. - "B" DIM.
2. PRESS IN BUSHINGS DEEP ENOUGH TO UPSET METAL AROUND HOLE TO LOCK IN STEEL SHEET.
3. SEE FOLLOWING PAGES.

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

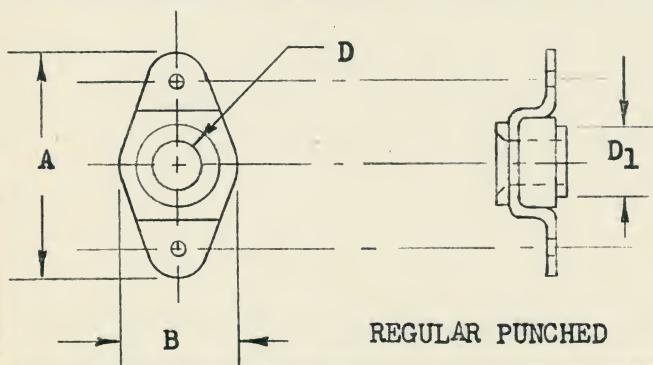
DRILL PLATE
WITH ANCHOR AND PEM TYPE DRILL BUSHINGS
CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
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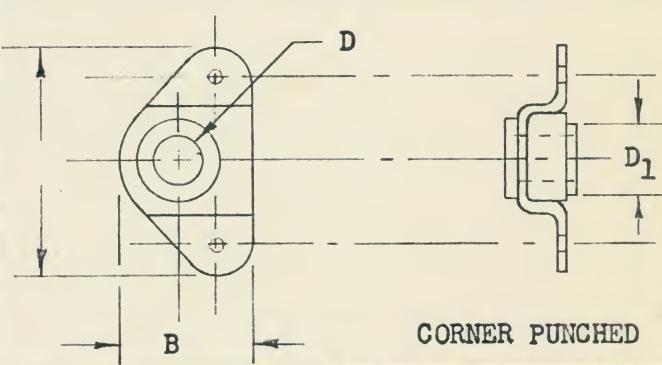
TODT 1J 7213
LOC. DWL.
(REF.)



TYP. APPLICATION (NO SCALE)



REGULAR PUNCHED



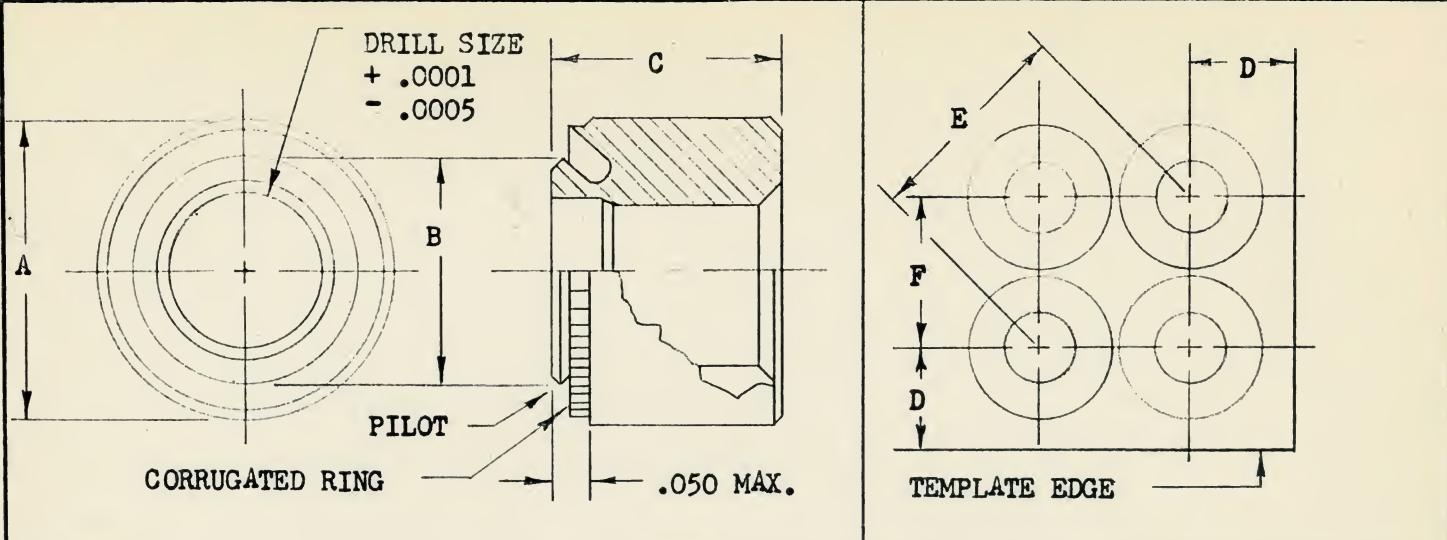
CORNER PUNCHED

DRILL SIZE	TEMP HOLE SIZE	REGULAR PUNCHED			CORNER PUNCHED		
		CVAC NO.	A	B	CVAC NO.	A	B
D	D ₁						
.0670					BUS 1655-5		
.0995					BUS 1655-15		
.1285	.250	BUS 1650-10				1.06	.59
.1470		BUS 1650-15					
.1610		BUS 1650-25			BUS 1655-25		
.1695		BUS 1650-30			BUS 1655-35		
.1910		BUS 1650-35				1.25	.694
.2130	.375	BUS 1650-40					
.2280		BUS 1650-45					
.2500		BUS 1650-50					
.2570		BUS 1650-55					
.2810		BUS 1650-60					
.3125	.562	BUS 1650-65	1.47	.81		1.47	.285

METHOD OF APPLICATION

1. PIERCE HOLES IN #18 GAUGE STEEL
2. SPOTWELD OR RIVET ANCHOR BUSHING TO STEEL SHEET.
3. FOR CONTOURED DRPE'S, FORM TABS ON ANCHOR BUSHING TO CONTOUR.

DRAWN	CAME 10-25-56	ANCHOR DRILL BUSHINGS & LOC. DWL FOR USE ON DRPE'S	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 11-1-56			
APPROVED				
APPROVED				PAGE 61



MINIMUM PATTERN AND EDGE DISTANCE

DRILL SIZE	TEMP. HOLE SIZE +.002 -.000	A	B +.003 -.000	C	D	E	F	MFG'S TYPE #	CVAC # BUS 2250
.0670	.250	.38	.252	.34	.25	.53	.38	P B 0	2250
.0995	.250	.38	.252	.34	.25	.53	.38	P B 0	2250 - 35
.1285	.250	.38	.252	.34	.25	.53	.38	P B 0	2250 - 5
.1470	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 45
.1610	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 10
.1695	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 50
.1850	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 55
.1910	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 15
.2130	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 60
.2280	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 65
.2500	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 30
.2570	.375	.50	.377	.38	.38	.72	.50	P B 1	2250 - 40
.2810	.562	.68	.564	.50	.56	.97	.68	P B 2	2250 - 70
.3125	.562	.68	.564	.50	.56	.97	.68	P B 2	2250 - 75

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

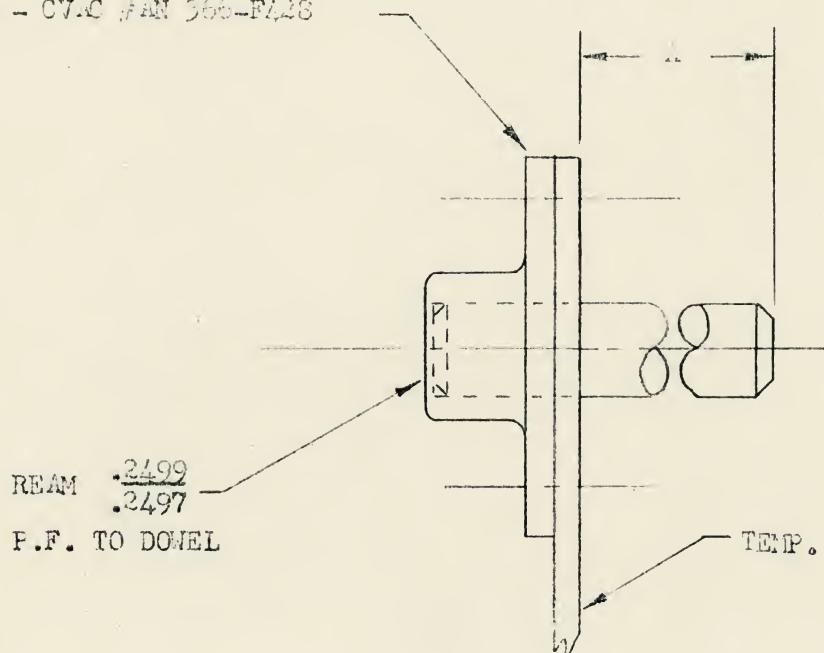
PEM TEMPLATE DRILL BUSHINGS

CONVAIR
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TOOL FABRICATION
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USE - CVAC #AN 366-P428



1J 7213 LOCATING DOWEL

DIAH NO.	A
-1	.06
-2	.12
-3	.25
-4	.50

DRAWN	CATE 10-2A-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

LOCATING DOWEL

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ETCH TEMPLATE

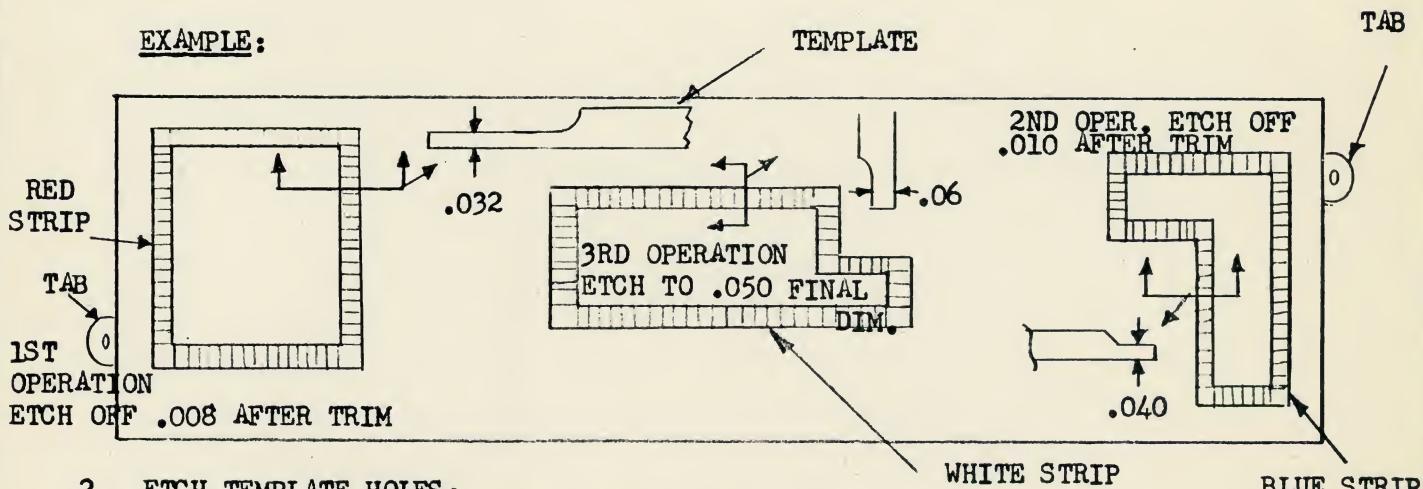
ETCH TEMPLATE IS A TOOL USED IN TRIMMING THE MASKING ON PARTS PRIOR TO CHEMICAL ETCHING. THE TOOL WILL MATCH THE INTERIOR OR EXTERIOR CURVATURE OF THE PART AND WILL CONTAIN COORDINATED LOCATING HOLES. THE INTERIOR AND/OR EXTERIOR EDGES OF THIS TOOL EXACTLY LOCATE THE LINES WHERE THE MASK IS TO BE TRIMMED. THE EDGES OF THE TOOL WILL BE COLOR CODED TO INDICATE SEQUENCE OF TRIMMING OPERATION, AND WILL INCORPORATE ALLOWANCE FOR EAT BACK ON PART DURING THE ETCHING.
ETTP - WILL BE PAINTED BLACK.

1. COLOR CODE: WHEN MORE THAN ONE ETCH OPERATION IS TO BE USED THE FOLLOWING COLOR CODE IS RECOMMENDED.

(a) RED	1ST OPERATION	(e) GREEN	5TH OPERATION
(b) BLUE	2ND OPERATION	(f) ORANGE	6TH OPERATION
(c) WHITE	3RD OPERATION	(g) GRAY	7TH OPERATION
(d) YELLOW	4TH OPERATION		

A STRIP PAINTED ALONG THE AREA TO BE ETCHED SHOWING SECTIONAL VIEW OF FINAL DEPTH. IN ADDITION, EACH AREA WILL BE CLEARLY STAMPED TO INDICATE WHEN IT IS TO BE USED AND WILL CALL OUT AMOUNT TO BE ETCHED FROM AREA AFTER MASKING IS TRIMMED. THE FIRST OPERATION WILL BE THE DEEPEST ETCHED AREA, SECOND OPERATION SECOND DEEPEST AND SO ON.

EXAMPLE:



2. ETCH TEMPLATE HOLES:

- (a) .250 ACTUAL SIZE HOLES IN "ETTP"
- (b) LOCATION OF "ETTP" HOLES TO BE DETERMINED BY TEMPLATE SHOP.
- (c) EDGE DISTANCE TO BE AT LEAST .30 FROM CENTER OF HOLE TO E.O.P. OF PART OR EDGE OF TAB.
- (d) HOLES TO BE FOOLPROOF.
- (e) HOLES TO BE COORDINATED TO THE DRILLING TOOL SUCH AS "DRTP", "DRSH", ETC.
- (f) ONE SET OF HOLES WILL BE USED FOR ALL ETCH TEMPLATES REQUIRED FOR A PART.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ETCH TEMPLATE DATA

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TOOL FABRICATION
PROCEDURES
MANUAL

3. TRIM

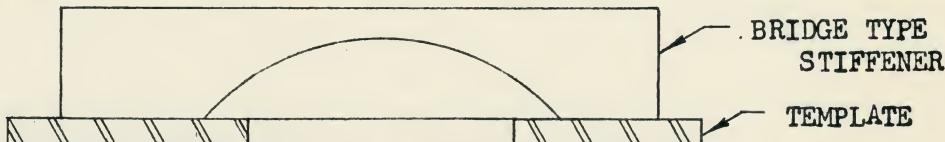
- (a) ON LARGE PARTS THAT HAVE MORE THAN ONE FLANGE OR COMPOUND CONTOUR, WHERE A ROUTER FORM WOULD BE IMPRACTICAL NO TRIM SHOULD BE ALLOWED, EXCEPT FOR TABS FOR "ETTP" HOLES.
- (b) ON DOORS, DOUBLERS, FLAT PARTS AND SIMPLE CONTOURS AT LEAST 1/2 INCH TRIM SHOULD BE ALLOWED.

4. TOOL DESIGN:

- (a) TOOL DESIGN REQUIRED ONLY ON CLOSE TOLERANCE PARTS, SUCH AS, DOORS, AND DOUBLERS OR CLOSE COORDINATION PARTS.
- (b) NO TOOL DESIGN REQUIRED ON FRAMES.

5. MANUFACTURE OF TEMPLATES:

- (a) STIFFENERS ACROSS ETCHED AREAS TO BE REMOVABLE OR BRIDGE TYPE, SUCH AS:



THESE STIFFENERS SHALL BE PLAINLY STAMPED "STIFFENERS ONLY".
STIFFENERS TO BE KEPT TO A BARE MINIMUM.

- (b) WHEN A FORMED TEMPLATE IS IMPRACTICAL DUE TO DIRECTION OF FLANGE OR DANGER OF DAMAGE TO MASKING EMULSION (SCRATCHING, IMPROPER FIT DUE TO EMULSION BUILD-UP, ETC.) "ETTP's" SHALL BE CUT TO THE TANGENT OF THE RADIUS OF THE FLANGES LESS .030 FOR MASK AND BUILD-UP.
- (c) MINIMUM OF "ETTP's" TO BE USED. "ETTP" TO INCORPORATE AS MANY DIFFERENT DEPTHS ON ONE TEMPLATE AS PRACTICAL.
- (d) IF MORE THAN ONE "ETTP" IS MADE FOR A PART EACH SEGMENT IS TO BE STAMPED "P".

MAIN TOOL TO SHOW HOW MANY TOOLS SUCH AS:

P4 4 TOOLS
P3 3 TOOLS, ETC.

- (e) UNDERCUT (EAT BACK) SHALL BE FIGURED PER THE FOLLOWING PAGES. ON CLOSE TOLERANCE PARTS IT IS NECESSARY TO RUN A TEST SAMPLE AS VARYING CONDITIONS MAKE IT IMPOSSIBLE AT PRESENT TO ESTABLISH A SET METHOD OF CALCULATING THE AMOUNT OF EAT BACK.

- (f) STANDARD TEMPLATE STOCK TO BE USED FOR ALL TEMPLATES.

6. TOOL ORDERS

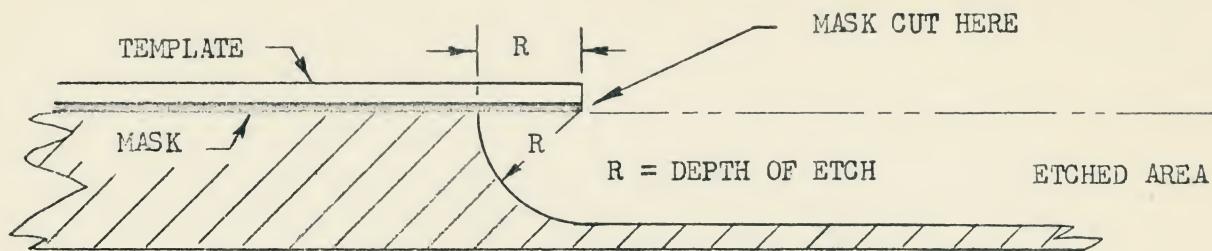
- (a) TO SHOW AGE AND HEAT TREAT.
- (b) SPECIFY EXACT NUMBER OF DEPTHS TO BE ACCOMPLISHED BY "ETTP".
- (c) TOOL CARD NOT TO INDICATE NUMBER OF "ETTP's" NEEDED TO ACCOMPLISH ETCH.
- (d) TOOL ORDERS TO SHOW TOOL SERIAL NO. OF COORDINATION TOOL, SUCH AS, "DRSH", ETC.
- (e) TOOL ORDERS TO SHOW IF ETCH IS PERFORMED BEFORE OR AFTER FORMING.
- (f) LOCATING HOLES FOR "ETTP's" TO BE LEFT TO DISCRETION OF SHOP.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ETCH TEMPLATE DATA
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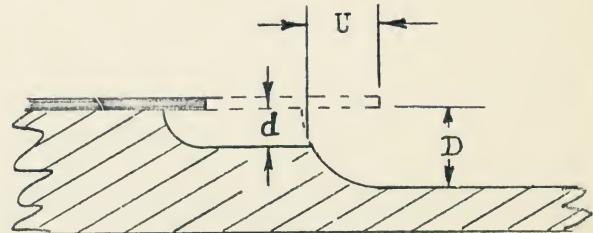
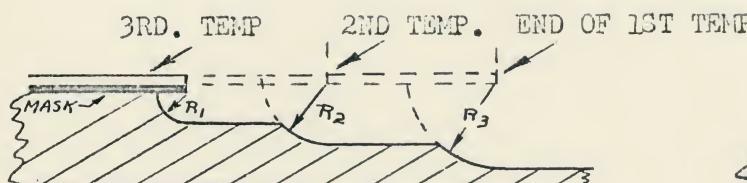
TOOL FABRICATION
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THE ETCHEANT SOLUTION REMOVES METAL AT APPROXIMATELY AN EQUAL RATE IN ALL DIRECTIONS. THIS REQUIRES THAT THE MASK BE CUT AT A POINT INSIDE THE ETCHED AREA AN AMOUNT EQUAL TO THE TOTAL DEPTH OF ETCHE. THE TEMPLATE MUST INCORPORATE THIS ALLOWANCE FOR EAT-BACK.



THE RADIUS EVOLVED AND TEMPLATE ALLOWANCE MUST BE BASED ON TOTAL DEPTH AND NOT ON DIFFERENCE IN DEPTHS OF ETCHED AREAS.

TO CALCULATE THE TEMPLATE ALLOWANCE TO BE MADE FOR STEPPED ETCHE'S SUCH AS FOR THE EDGE OF THE FIRST TEMPLATE THE FORMULA SHOWN BELOW CAN BE USED.



$$U = \sqrt{D^2 - d^2}$$

U = EAT BACK ALLOWANCE

D = DEPTH OF ETCHE AT BOTTOM OF STEP

d = DEPTH OF ETCHE AT TOP OF STEP

EXAMPLE - 3 STEP TEMPLATE

$$\begin{aligned} R_1 &= .030 & \text{1ST TEMP.} \\ U &= \sqrt{R_3^2 - R_2^2} \end{aligned}$$

$$R_2 = .060 \quad U = \sqrt{.0081 - .0036} = \sqrt{.0045}$$

$$R_3 = .090 \quad U = .067$$

$$\begin{aligned} 2\text{ND TEMP.} \\ U = \sqrt{R_2^2 - R_1^2} \end{aligned}$$

$$U = \sqrt{.0036 - .0009} = \sqrt{.0027}$$

$$U = .051$$

$$\begin{aligned} 3\text{RD TEMP.} \\ U = D = R_1 \end{aligned}$$

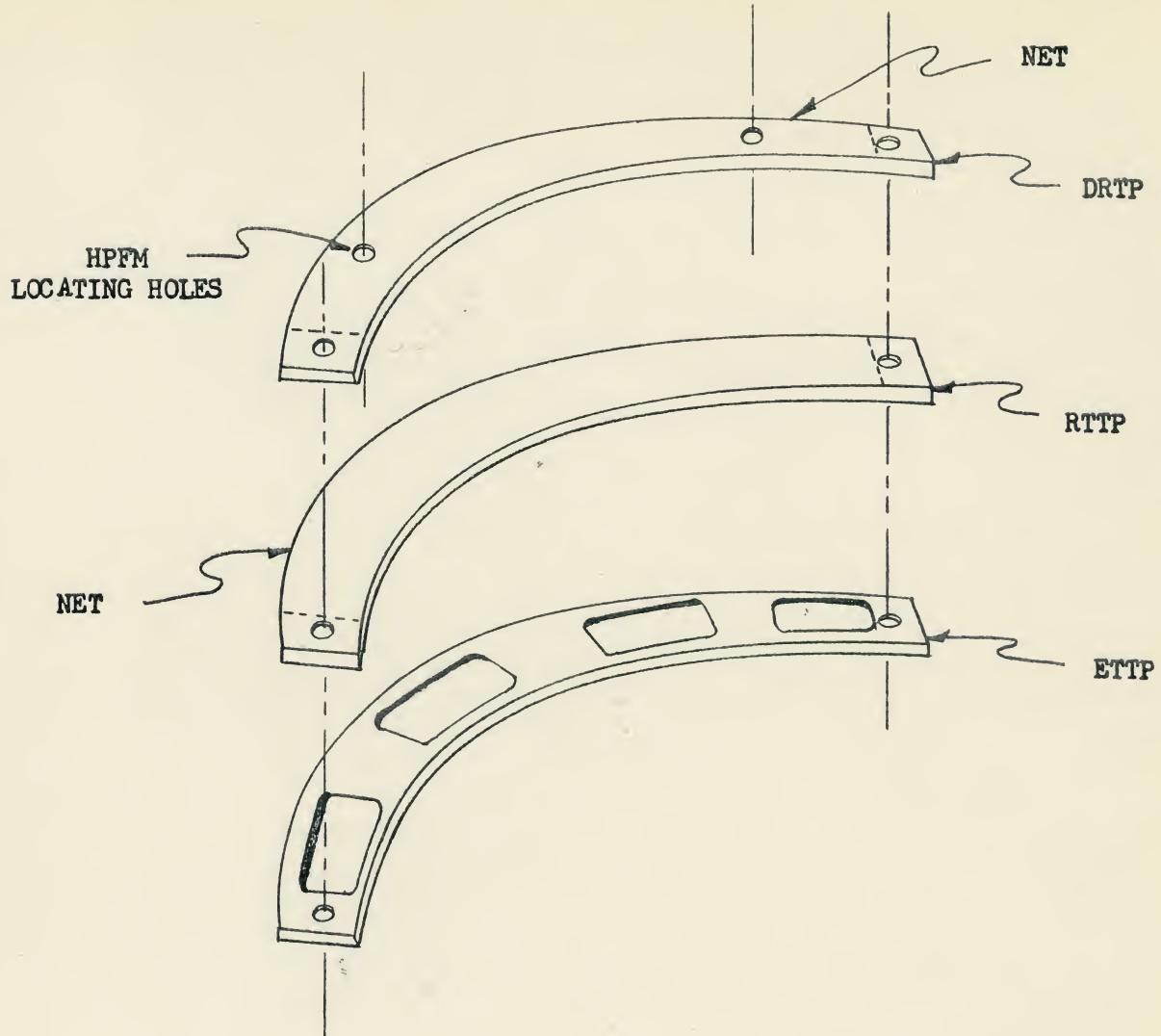
$$D = .030$$

DRAWN	CMM 10-2/56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ETCH TEMPLATE DATA

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DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ETCH TEMPLATE
TOOL ILLUSTRATION

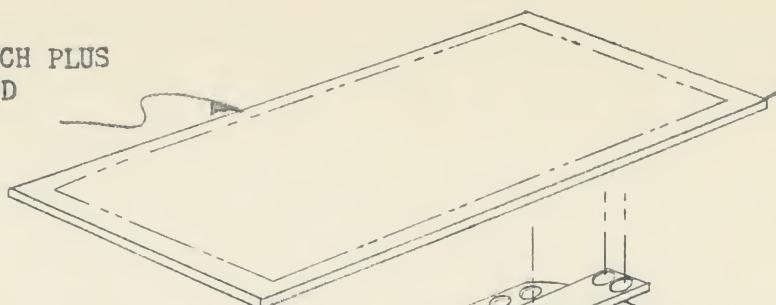
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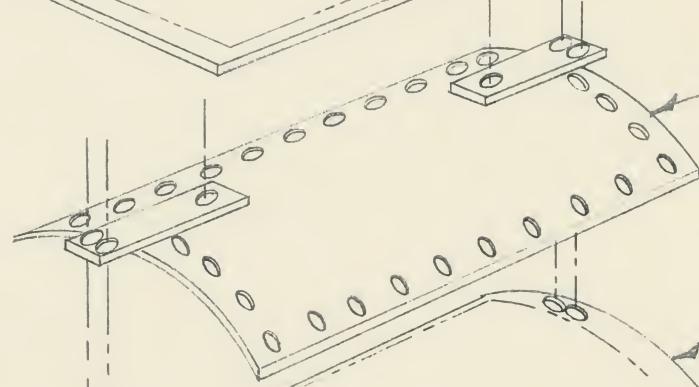
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1/2" EXCESS FOR ETCH PLUS
ANY EXCESS REQUIRED
FOR FORM

MKTP



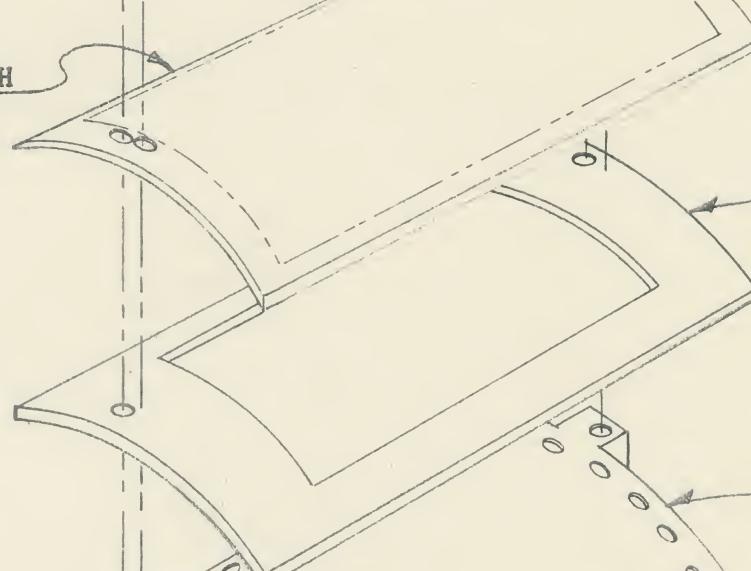
TOGA



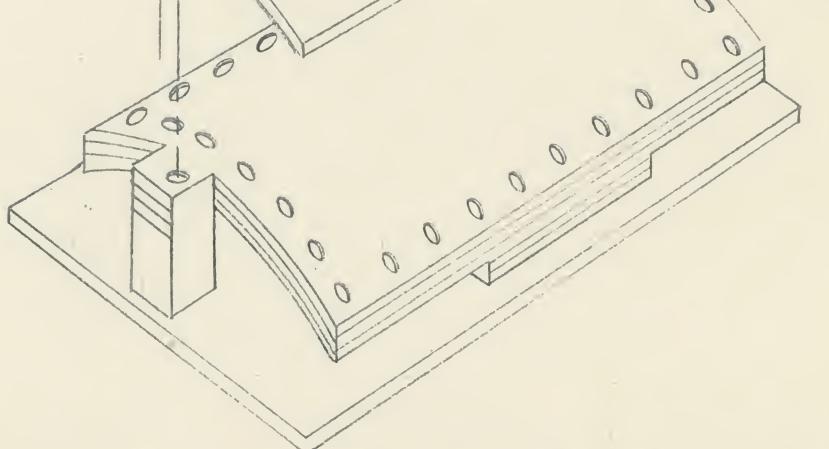
DRSH

1/2" EXCESS FOR ETCH
(ROUGH TRIM)

ETTP



DRJI



DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

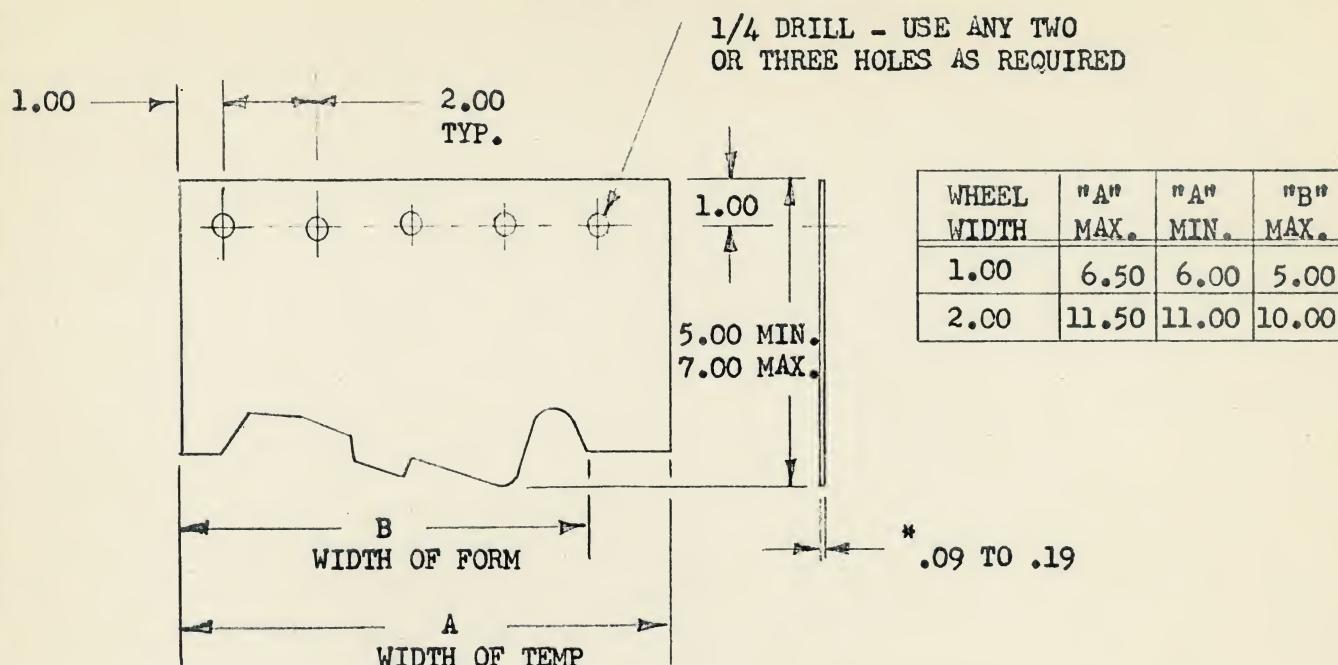
ETCH TEMPLATE
TOOL ILLUSTRATION

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GRINDING TEMPLATE "GRTP"



* THE TEMPLATE MUST BE FLAT AS A WARPED TEMPLATE WILL CAUSE ERRORS IN FORM. TEMPLATE MUST BE .093 PLUS OR MINUS .002 IF A MATING TEMPLATE IS TO BE CAST IN TEMPLATE CASTING FLASK.

THE FORM ON THE TEMPLATE IS THE SAME AS THE FORM ON GRINDING WHEEL WITH A 5 TO 1 RATIO, BUT IS OPPOSITE OF THE FORM TO BE GROUND ON THE WORK.

A MATING TEMPLATE CAN BE CAST TO MATCH TEMPLATE FABRICATED FROM SHEET STOCK BY USING TEMPLATE CASTING FLASK. IF MATING TEMPLATES ARE REQUIRED FABRICATE WHICHEVER ONE IS EASIER TO MAKE FROM SHEET STOCK AND THEN CAST MATING ONE.

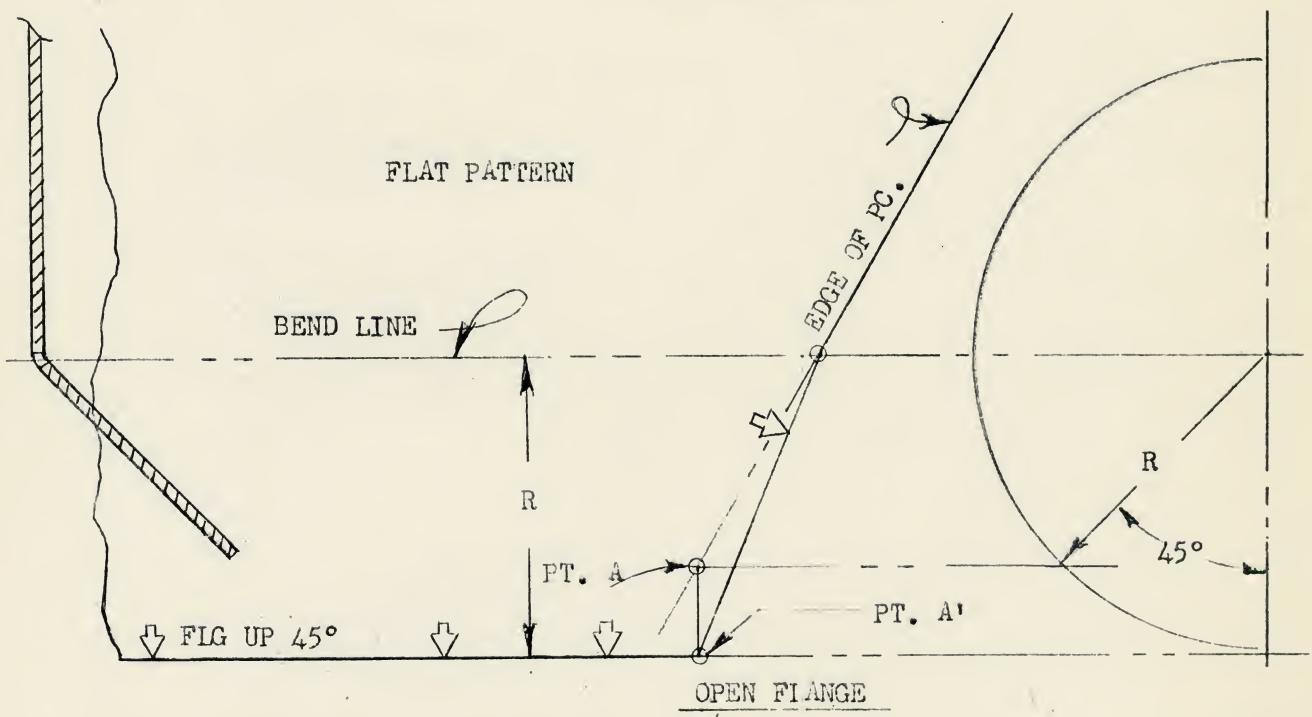
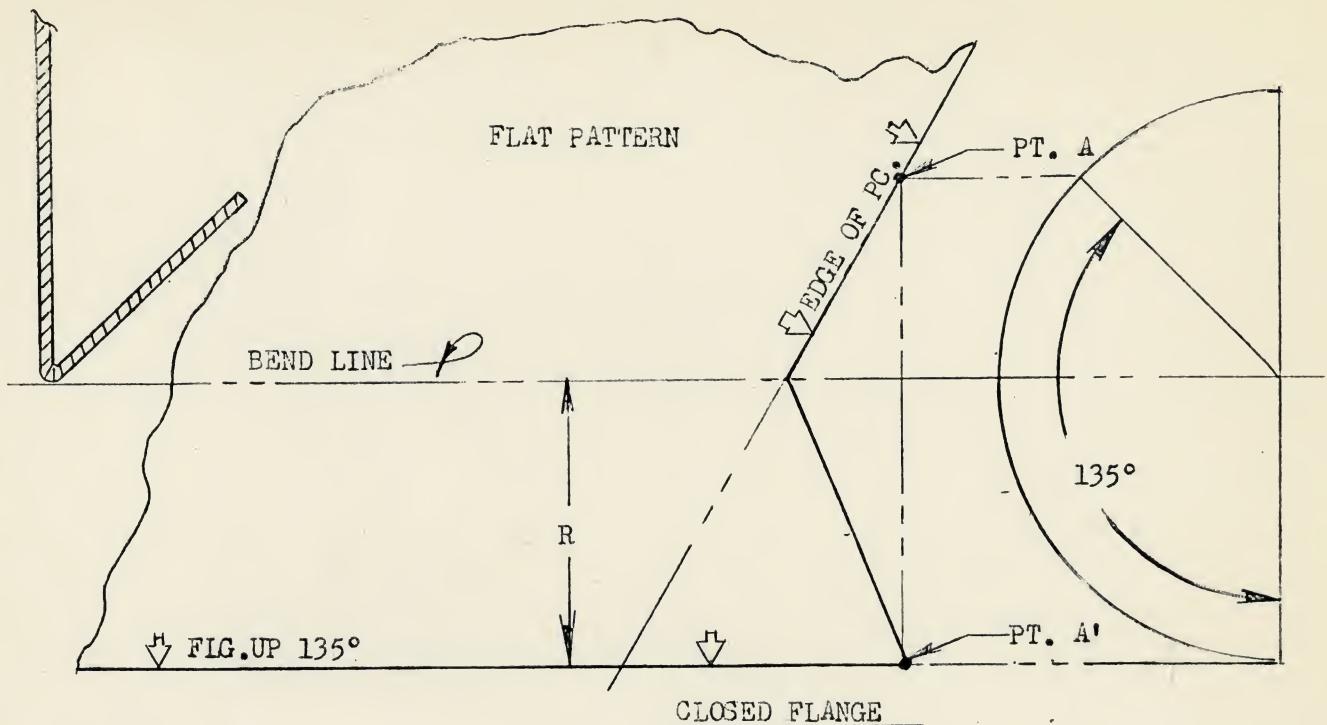
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

GRINDING TEMPLATES (GRTP)
DIAFORM WHEEL FORMING ATTACH.

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R DEVELOPED LENGTH OF FLANGE

PT. A' (CORNER OF FLANGE) DETERMINED BY PROJECTION OF PT. A

DRAWN	CAME 10-15-56
CHECKED	ROBBINS 10-20-56
APPROVED	
APPROVED	

MARK TEMPLATE - DEV. FLAT PATTERN

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ALL RELIEF RADII SHALL BE .183 FOR GAGES UP TO AND INCLUDING .091 MATERIAL AND .250 FOR GAGES OVER .091 MATERIAL. IF THE DESIGN REQUIRES A SLOT ("A" DIMENSION) THAT IS NOT .375 OR .50, THE RELIEF RADII SHALL EQUAL ONE-HALF THE SLOT WIDTH EXCEPT FOR CONDITION AS SHOWN IN FIGURE #9.

A - .375 OR .50 FOR SLOTS UP TO 3" LONG FOR GAGES OF .064 AND UNDER, .094 MAY BE USED IF APPROVED BY "TOOL DESIGN ENGINEER".

B - .031 FOR GAGES UP TO .102 AND .062 FOR GAGES OF .125 AND OVER.

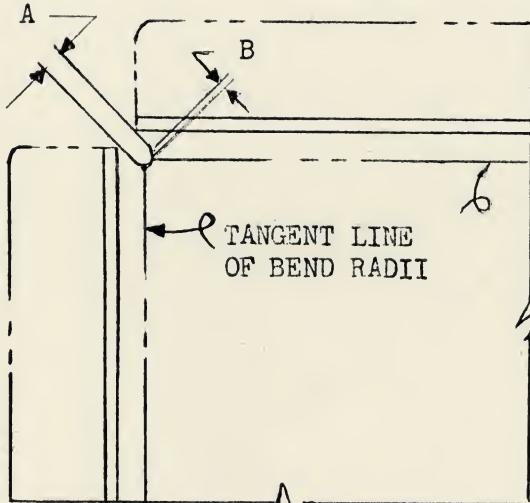


FIGURE 1

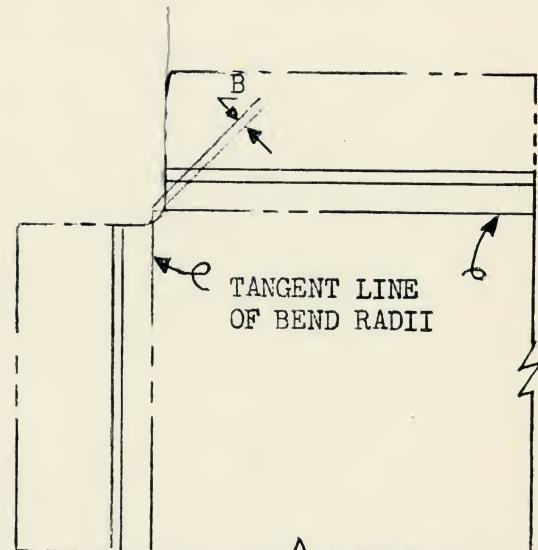


FIGURE 2

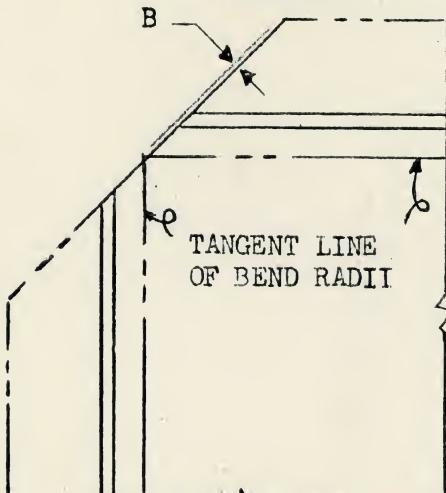
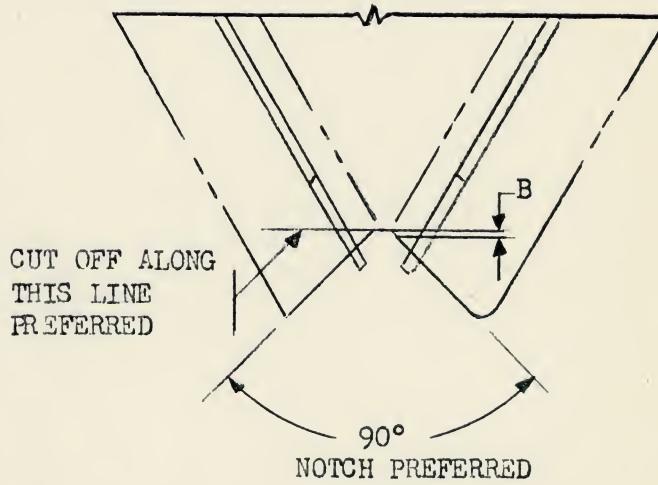


FIGURE 3



90°
NOTCH PREFERRED

FIGURE 4

NOTE: INTERSECTIONS OF BL & RELIEF TO BE DRAWN AS SHOWN, NOT AS FINISHED PART MAY APPEAR.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-10
APPROVED	
APPROVED	

MARK TEMPLATE
DEV. OF RELIEF RADII

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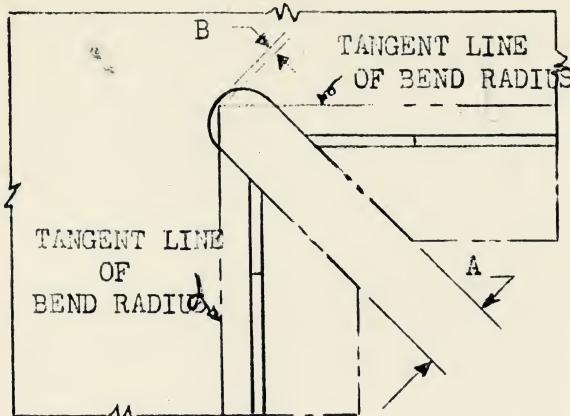


FIGURE 5

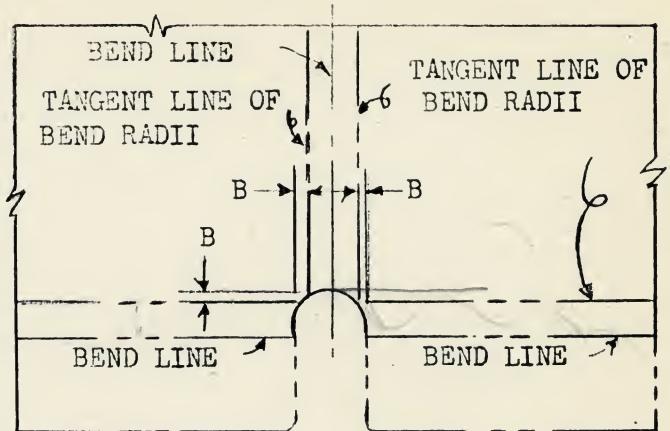


FIGURE 8

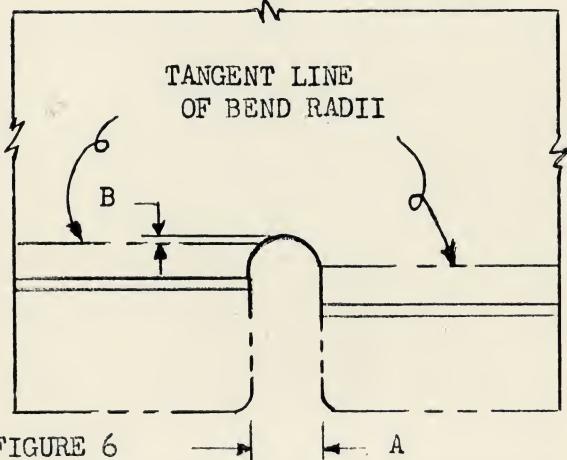


FIGURE 6

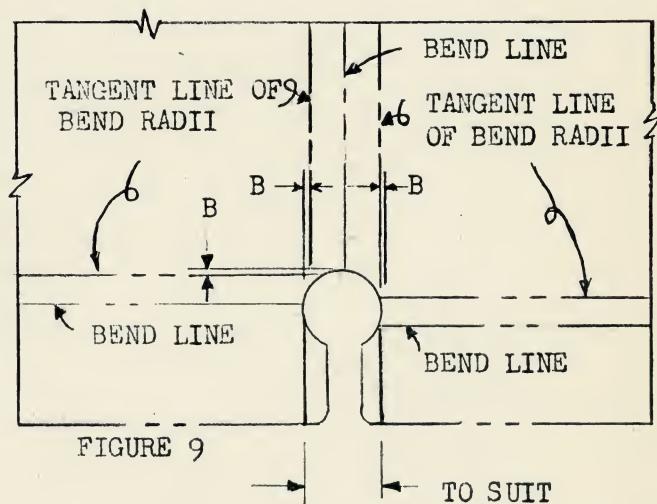
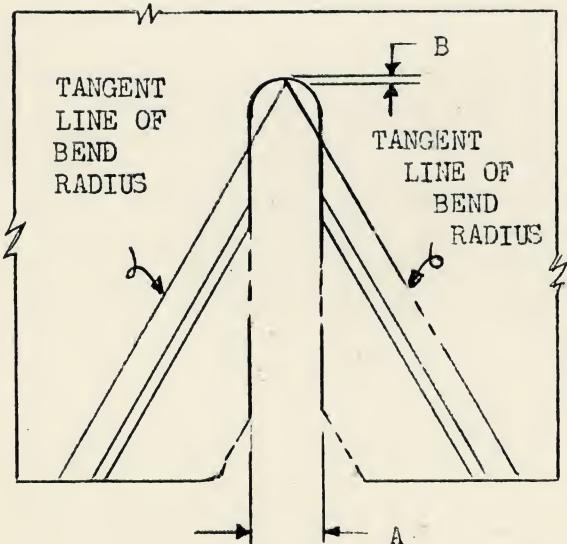


FIGURE 9



USE ONLY WHEN NECESSARY TO OBTAIN REQUIRED EDGE DISTANCE.

NOTE: INTERSECTING OF B.L. & RELIEF TO BE DRAWN AS SHOWN, NOT AS THE FINISHED PART MAY APPEAR.

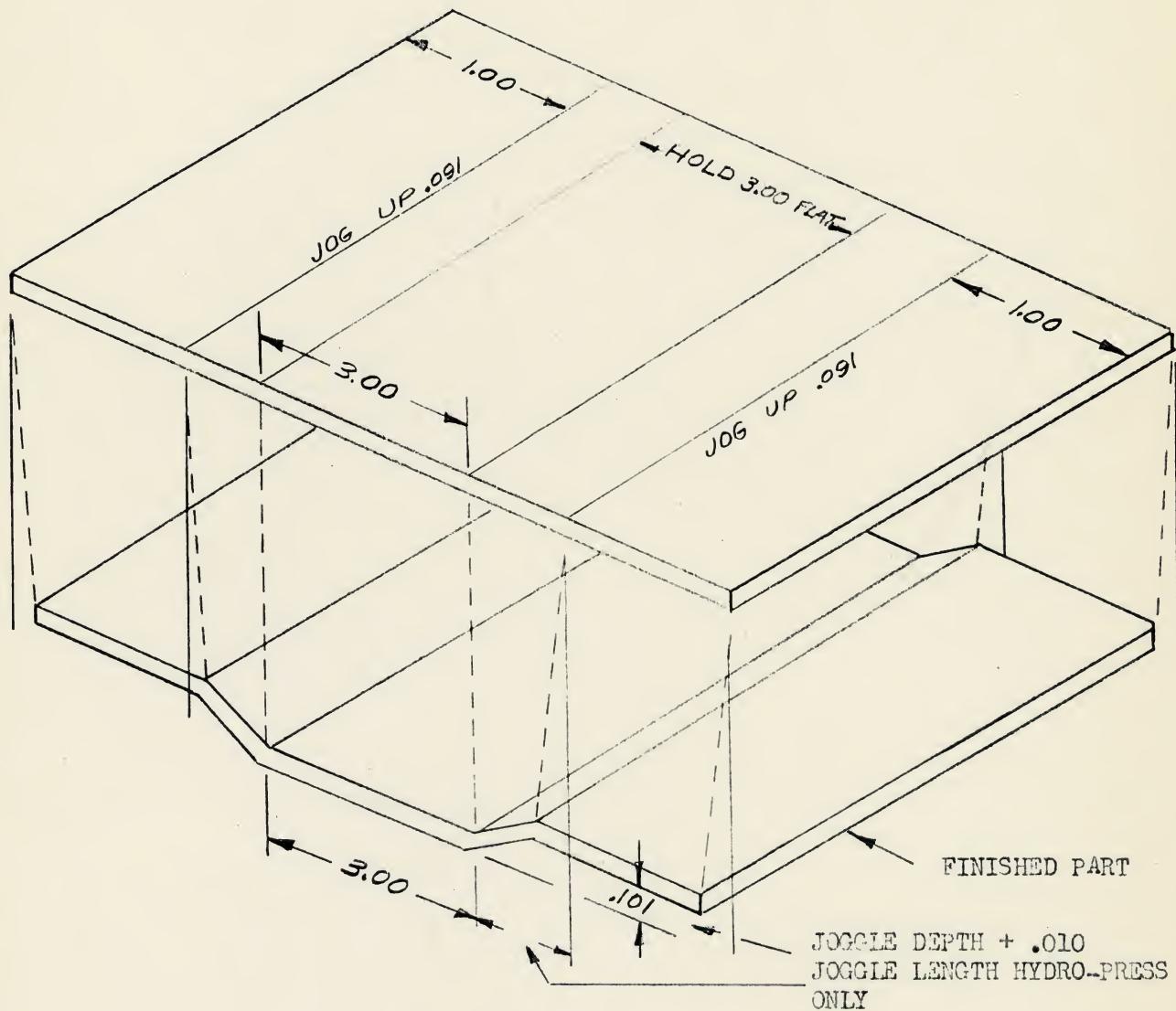
DRAWN	CAME 11-1-56
CHECKED	RO-BINS 11-10
APPROVED	
APPROVED	

MARK TEMPLATE
DEV. OF RELIEF RADII

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METHOD OF CALLING OUT DOUBLE JOGGLE WHEN GIVEN FLAT SPACE IS REQUIRED.

JOGGLE INFORMATION IS NOT TO BE CALLED OUT IN JOGGLED AREA.

JOGGLE LENGTH SHALL BE AT LEAST THREE TIMES ITS DEPTH.

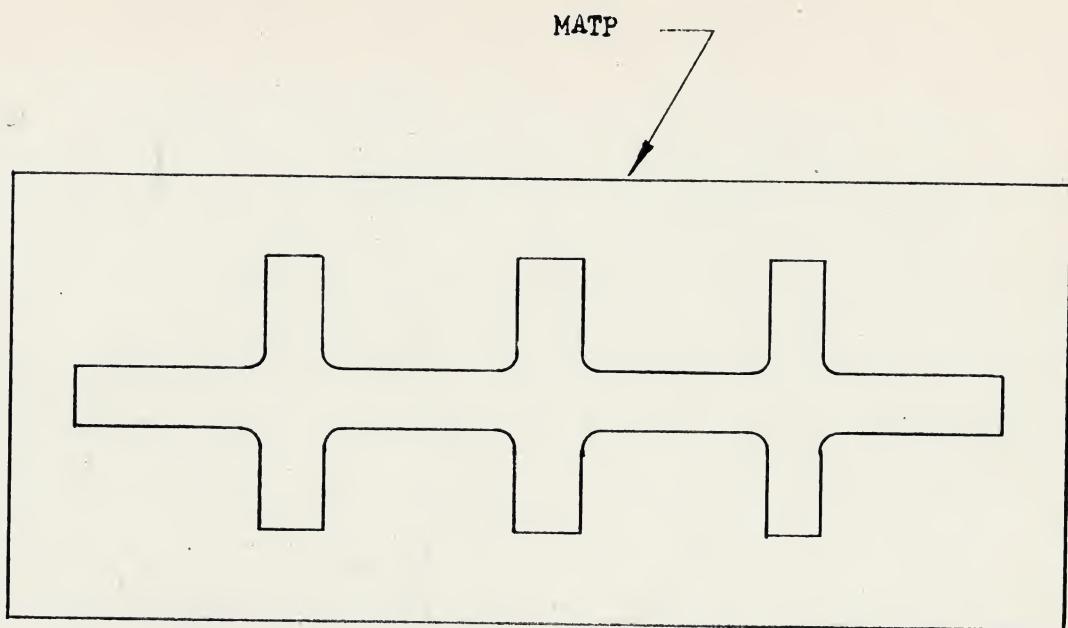
DRAWN	CAM 10-2A-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

MARK TEMPLATE
JOGGLE CALL OUT

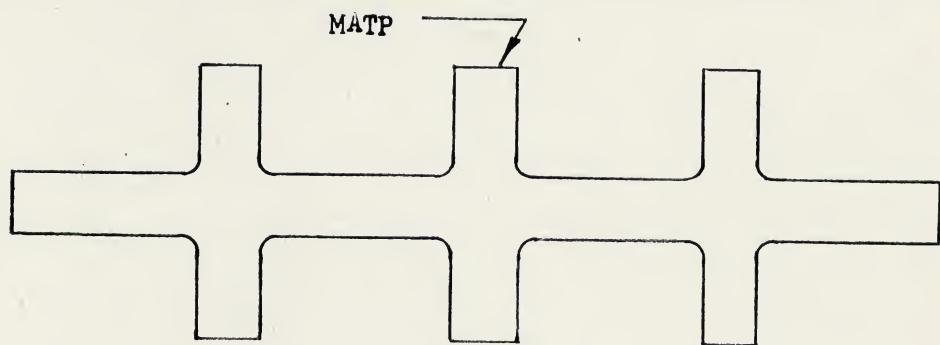
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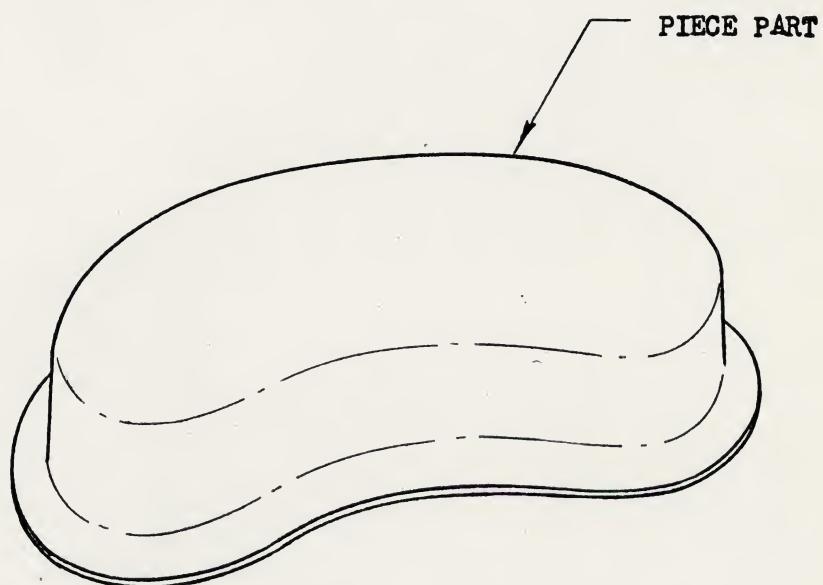
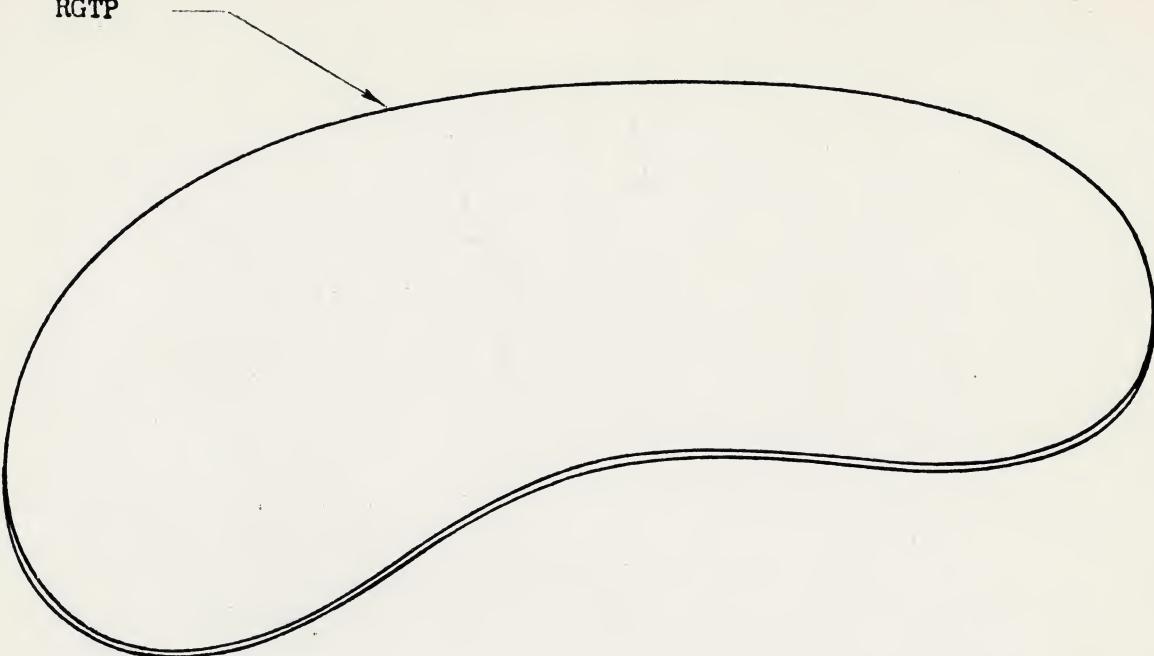
A TOOL USED ON CONTROLLING THE MASKING APPLICATION IN THOSE AREAS OF A PART WHICH REQUIRE PROTECTION FROM SUBSEQUENT SPRAY APPLICATIONS SUCH AS THE ADHESIVE BOND PRIMER USED ON "SCOTCH WELDING".



ANOTHER TYPE OF MATP IS USED FOR CUTTING ADHESIVE BOND MATERIAL TO DESIRED PATTERN OR SHAPE.

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

MASKING TEMPLATE "MATP" TOOL ILLUSTRATION	TOOL FABRICATION PROCEDURES MANUAL
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ROUGH TEMPLATE TO SHOW PERIMETER OF ROUGH SHAPE
WITH ALLOWANCE FOR FORMING

DEVELOP TO SUIT DIE

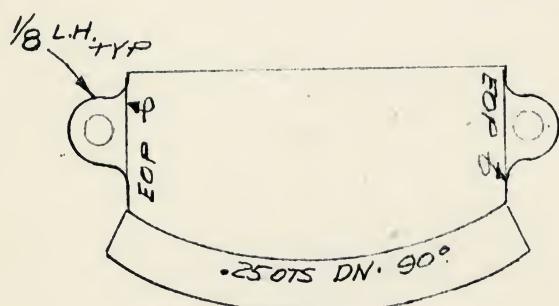
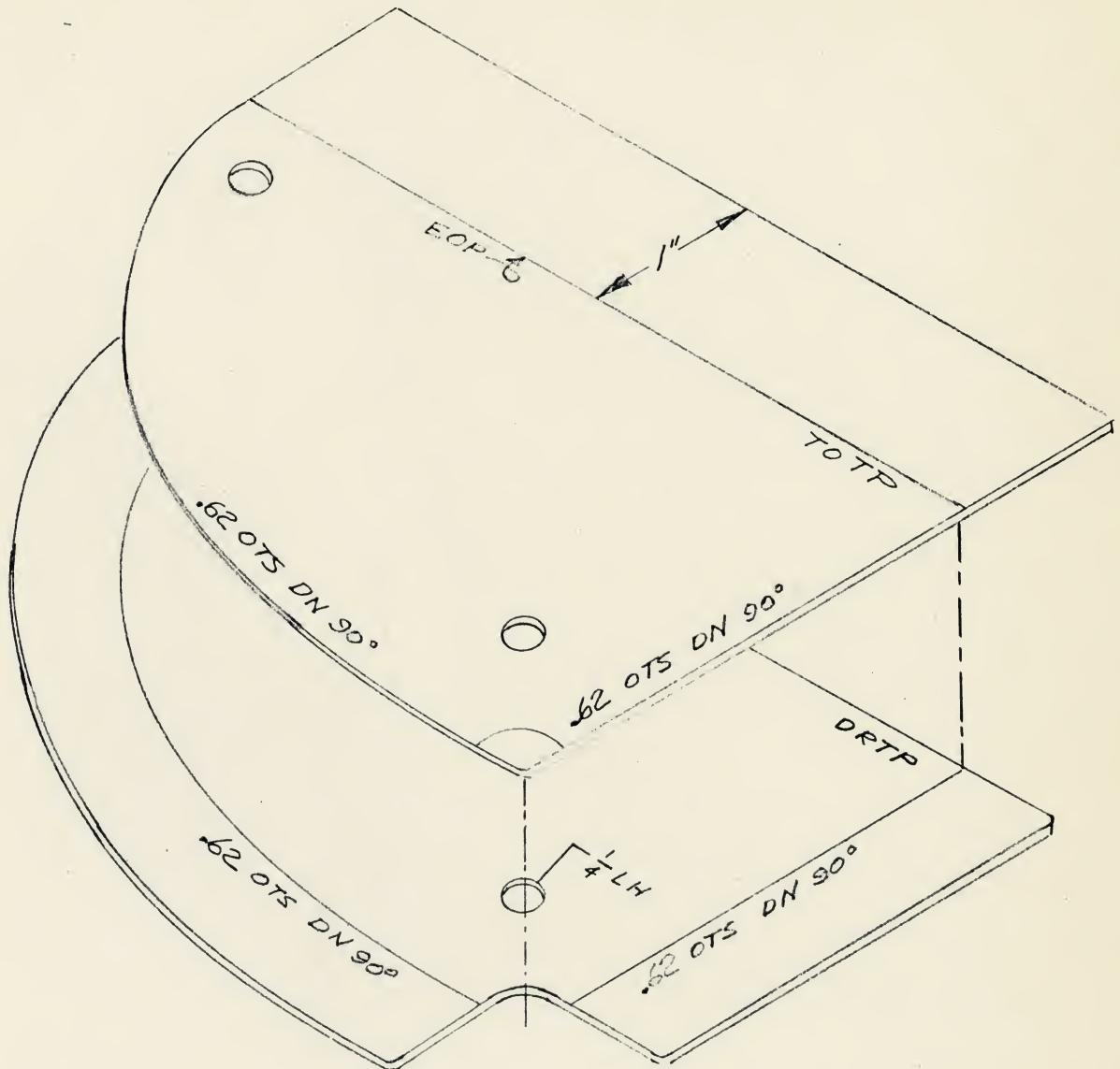
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ROUGH TEMPLATE "RGTP"
TOOL ILLUSTRATION

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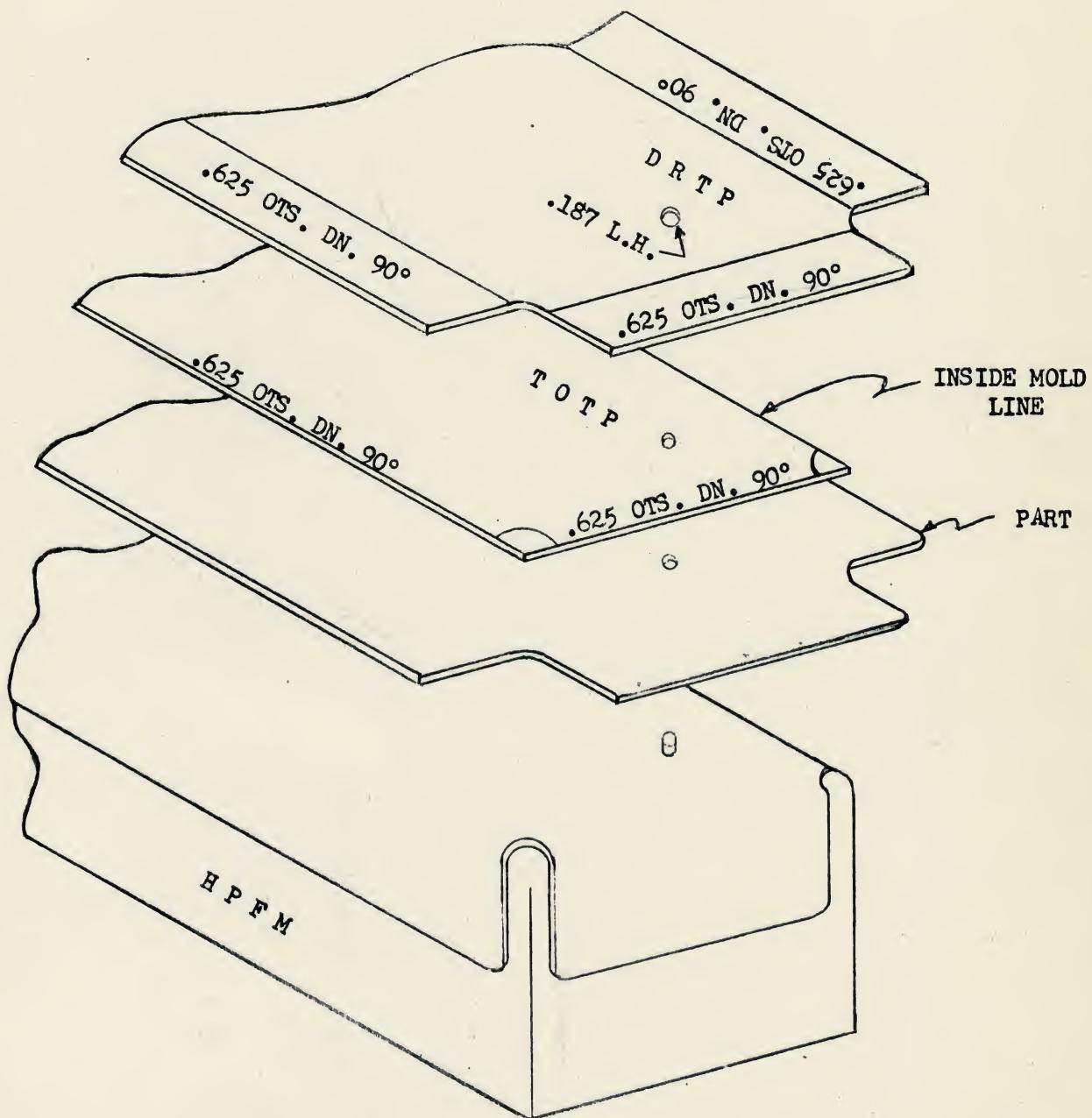


LOCATING HOLES MAY BE PUT IN TABS OUTSIDE OF PART WHEN THE PART IS TOO SMALL TO INCORPORATE THEM OR IN OTHER SPECIAL CASES WHEN LOCATING HOLES ARE UNDESIRABLE IN THE FINISHED PART. TABS TO BE TRIMMED AFTER FORMING.

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOLING TEMPLATE WITH
MATCHING DRTP TEMPLATE
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DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

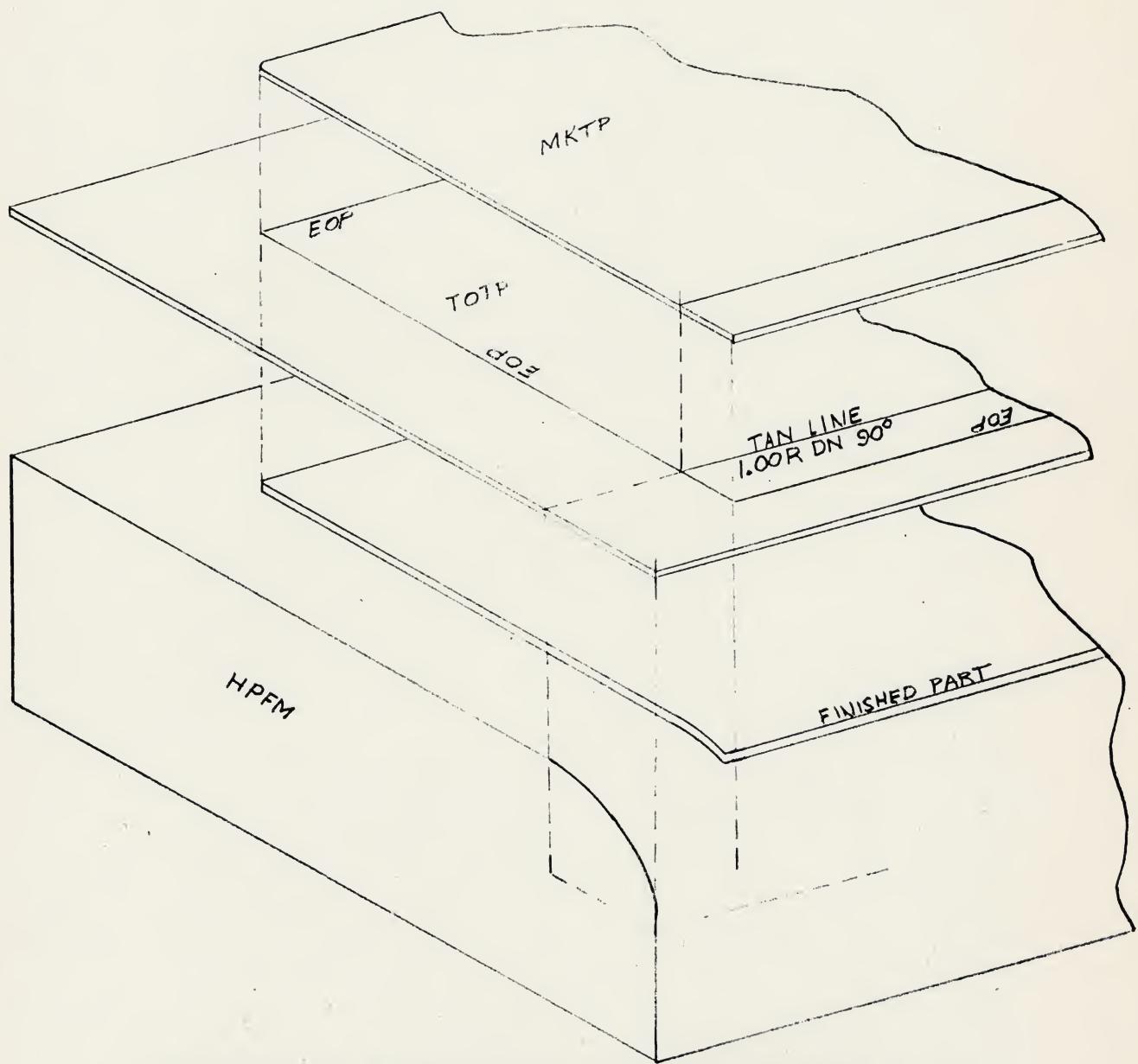
TEMPLATES TO FORM PART HYDRO-PRESS

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TOOL LOFT PROCEDURE



WHEN PART BEING FORMED IS SHORT OF MAKING FULL RADIUS THE TOTP SHOULD COME TO THE TANGENT LINE OF THE RADIUS. THE MKTP SHOULD SHOW THE LINE WHERE THE PART STARTS TO BEND.

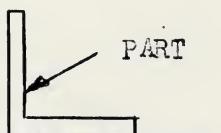
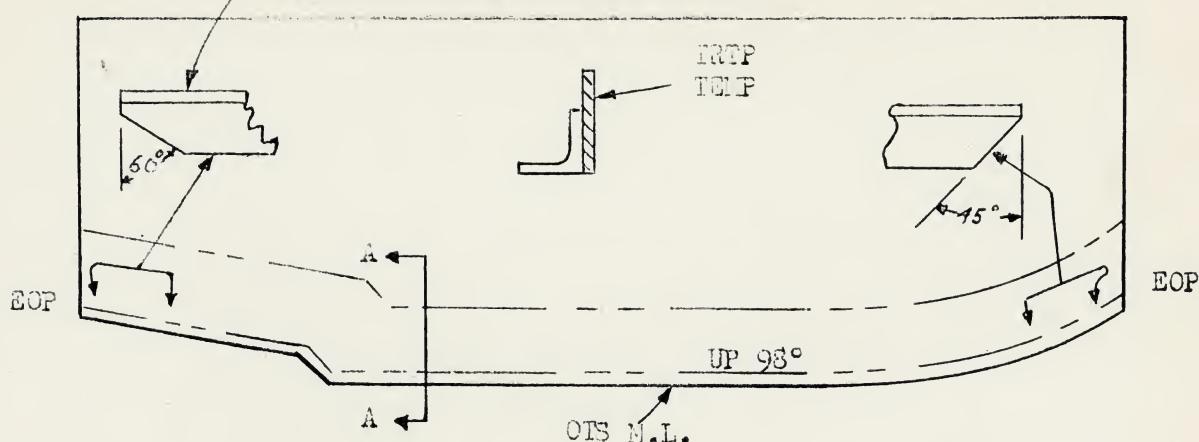
DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TOOLING TEMPLATE
PART SHORT OF FULL RADIUS
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THESE TRTP'S ARE FOR CUTTING LIDS ONLY & LOCATION OF JOGGLE

TYP. VIEWS FOR CUTS ON UP OR DOWN STANDING LEG
WHENEVER SHOWN ON DWG. OR TOLO

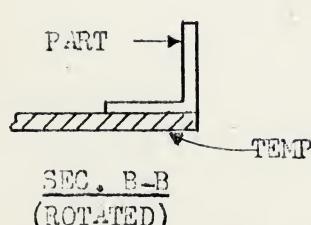
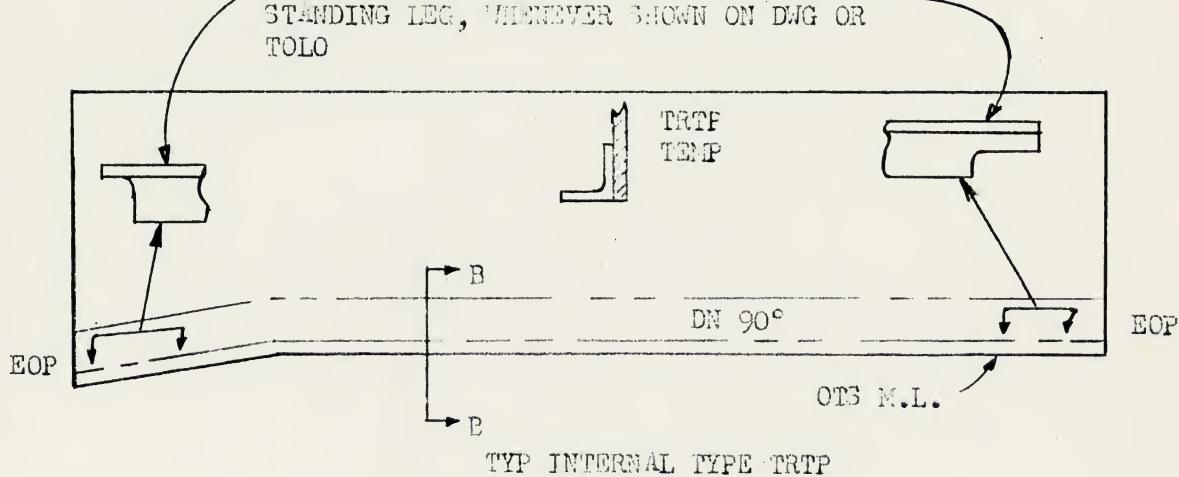


TYP. EXTERNAL TYPE TRTP

TEMP

SEC A-A
(ROTATED)

TYP. VIEWS FOR CUTOUTS IN UP OR DOWN
STANDING LEG, WHENEVER SHOWN ON DWG OR
TOLO



TRTP NOTES:

TRIM TO LENGTH & ENDCUTS, SHOW APPLICATION
SHOW ALL LINES, JOGGLES & HOLES

SEC. B-B
(ROTATED)

DRAWN	CASE 10-24-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

"TRTP" TOOL ILLUSTRATION

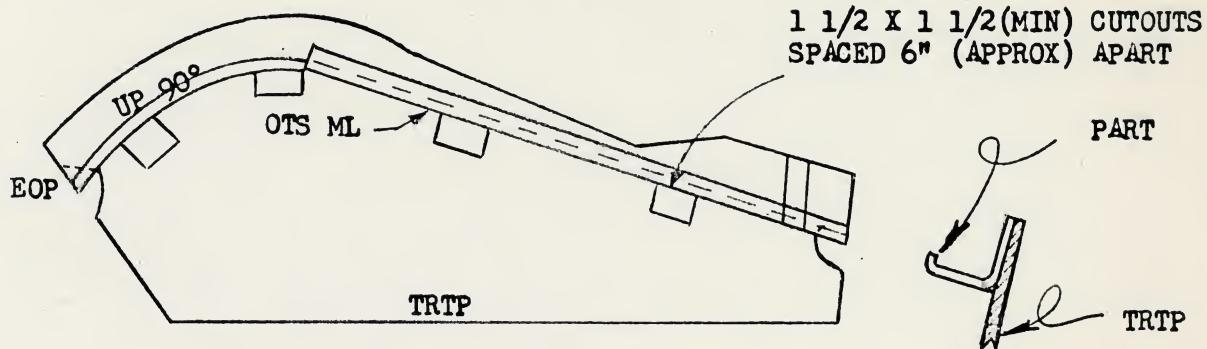
CONVAIR
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TOOL FABRICATION
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THIS TYPE TRTP FOR FAB RTFM

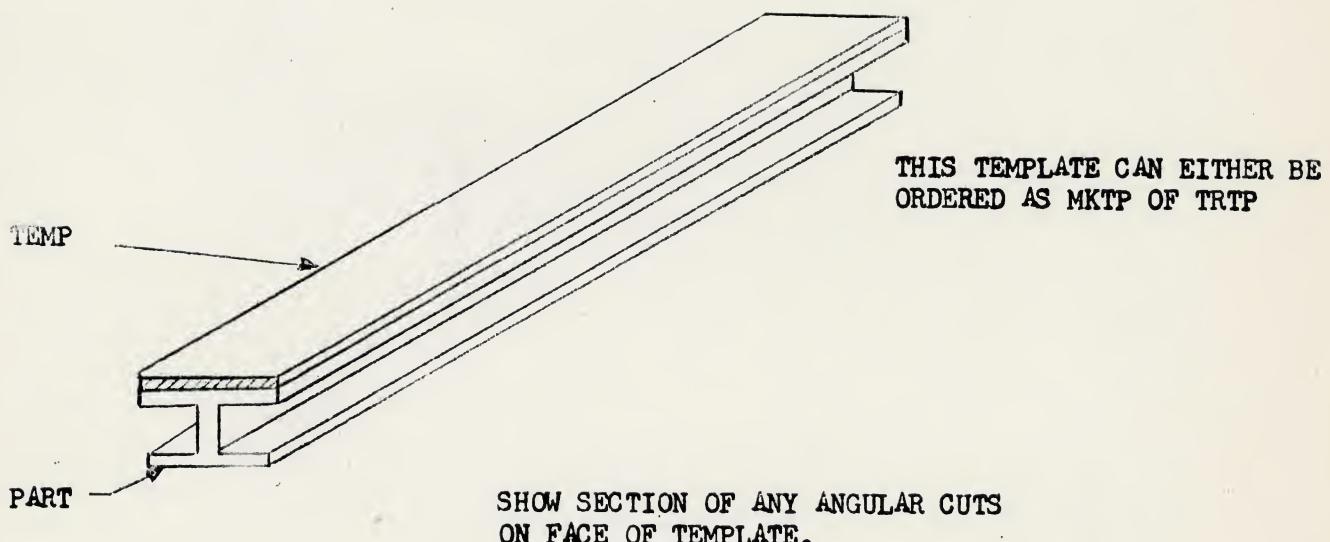
TRIM TO LENGTH & SIZE



TYP. TRTP SHOWING FLANGE
CUTOFF & JOGGLE

SHOW FLANGE CUTOFF, JOGGLE ON FACE
OF TEMPLATE AND APPLICATION

TRIM TO LENGTH & SIZE AS INDICATED



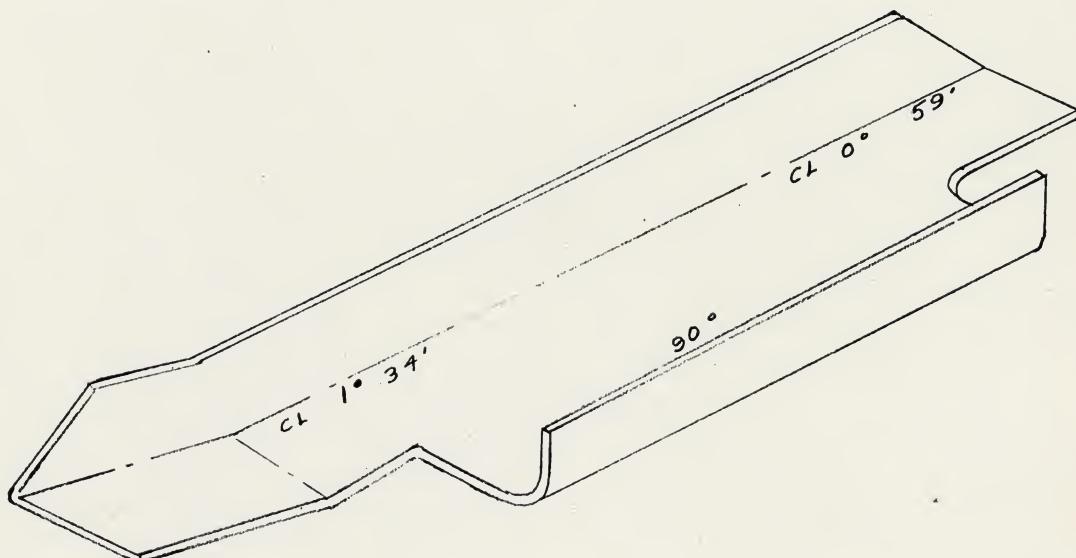
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TRIM TEMPLATE
TOOL ILLUSTRATION

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SAN DIEGO

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A FORMED "TRTP" (WHICH WILL BE A REPLICA OF A PRODUCTION PART - A PRODUCTION PART MAY BE USED) IS PREFERRED WHERE A FORMED PART IS INVOLVED.



THE EDGE OR MARKS ON THE SURFACE DETERMINE THE TRIM OF THE PART. JOGGLES AND OTHER INFORMATION ARE SHOWN OR INDICATED. HOLES AS REQUIRED BY PLANNING ARE SHOWN. THE TOOL IS PAINTED RED.

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TRIM TEMPLATE "TRTP"
TOOL ILLUSTRATION

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STANDARD MINIMUM BEND RADIUS FOR ALUMINUM AND ALUMINUM ALLOY
(0° TO 180°) BRAKE AND HYDROPRESS FORMING

STANDARD GAUGE	1100-O	2024-O	2024-T	7075-T
	3003-O	6061-W	7075-W	2024-RT
	5052-O	7075-O	6061-T	2014-T
	6061-O	5052-1/2H	1100-H	
		2014-O	2014-W	
		1100-1/2H		
.012	.03	.03	.03	.06
.016	.03	.03	.03	.06
.020	.03	.03	.03	.08
.025	.03	.03	.06	.09
.032	.03	.06	.09	.12
.040	.06	.06	.09	.19
.051	.06	.06	.12	.25
.064	.08	.09	.16	.31
.072	.09	.09	.19	.38
.081	.09	.12	.22	.44
.091	.12	.16	.25	.50
.102	.12	.16	.31	.56
.125	.16	.19	.38	.69
.156	.16	.25	.44	.88
.188	.19	.31	.69	1.00
.250	.25	.44	1.00	1.50

2024-T80 IS FORMED IN 2024-O CONDITION - USE 2024-O BEND RADIUS
 2024-T81 IS FORMED IN 2024-T CONDITION - USE 2024-T BEND RADIUS
 2024-T86 IS FORMED IN 2024-RT CONDITION - USE 2024-RT BEND RADIUS

DRAWN	CAME 10-23-56	STANDARD MINIMUM BEND RADII FOR ALUMINUM AND ALUMINUM ALLOY	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 11-1-56		
APPROVED		CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	PAGE 100
APPROVED			

MINIMUM STANDARD BEND RADII FOR MAGNESIUM ALLOY

STANDARD MINIMUM BEND RADII

MAGNESIUM ALLOYS
(0° TO 90°)

STANDARD GAUGE	DOW FS-la or AM-C52S-O		DOW FS-lh or AM-C52S-H		DOW JS-la or MA-C54S-O		DOW JS-lh or AM-C54S-H		DOW Ma or AM-3S-O		DOW Mh or AM-3S-H	
	COLD	HOT	COLD	HOT	COLD	HOT	COLD	HOT	COLD	HOT	COLD	HOT
.016	.09	.03	.19	.06	.16	.09	.31	.09	.16	.06	.25	.06
.020	.09	.06	.19	.09	.19	.09	.38	.12	.19	.06	.31	.09
.025	.12	.06	.25	.12	.22	.12	.50	.16	.19	.09	.38	.12
.032	.16	.06	.31	.12	.31	.16	.62	.19	.22	.09	.50	.19
.040	.19	.09	.38	.22	.38	.19	.81	.25	.25	.12	.62	.25
.051	.25	.09	.50	.25	.50	.25	1.00	.31	.31	.16	.75	.31
.064	.31	.12	.62	.38	.56	.31	1.25	.38	.38	.19	.88	.38
.072	.38	.16	.81	.44	.62	.38	1.50	.44	.44	.22	1.25	.50
.081	.44	.19	.81	.44	.75	.44	1.75	.50	.50	.25	1.25	.56
.091	.44	.19	.88	.44	.81	.50	2.00	.56	.56	.31	1.50	.62
.102	.50	.22	1.00	.44	1.00	.50	2.25	.62	.62	.31	1.75	.75
.125	.62	.25	1.25	.50	1.25	.62	2.50	.75	.75	.38	2.00	.88
.156	.75	.31	1.50	.62	1.50	.81	3.00	.88	1.00	.44	2.50	1.00
.188	1.00	.38	2.00	.81	1.75	1.00	4.00	1.00	1.25	.56	3.00	1.25
.250	1.25	.50	2.50	1.00	2.25	1.25	5.00	1.50	1.50	.75	4.00	1.75

DRAWN	CAME 10-23-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

MINIMUM STANDARD BEND RADII
FOR MAGNESIUM ALLOY

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A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

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PAGE 101

STANDARD BEND RADII FOR TITANIUM

STANDARD GAUGE	COMM. PURE (ANNEALED) OR ALLOY (ANNEALED)
.008	.03
.012	.03
.016	.06
.020	.06
.025	.09
.032	.09
.036	.12
.040	.12
.050	.16
.063	.19
.080	.25
.090	.31
.112	.38
.125	.38
.156	.44
.188	.56
.250	.75

DRAWN	CAME 10-22-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

STANDARD BEND RADII FOR TITANIUM

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STANDARD MINIMUM BEND RADII FOR CARBON STEEL & STEEL ALLOY 0° TO 90°: THIS BEND RADIUS IS PRODUCTION STANDARD. BEND RADII OTHER THAN THAT SHOWN IN TABLE BELOW SHALL NOT BE SPECIFIED UNLESS AUTHORIZED AND APPROVED BY THE PROPERLY DESIGNATED AUTHORITIES.

STANDARD MINIMUM BEND RADII

CARBON STEEL & STEEL ALLOY
(0° TO 90°)

STANDARD GAUGE	STEEL			CORROSION RESISTANT STEEL		
	1025 OR 4130 ANNEALED	4130 NORM.	ANNEALED	1/4 HARD	1/2 HARD	FULL HARD
.008	.03	.03	.03	.03	.03	.06
.012	.03	.03	.03	.03	.03	.09
.016	.03	.06	.03	.03	.06	.09
.020	.06	.06	.03	.03	.06	.12
.025	.06	.09	.03	.06	.09	.16
.030	.06	.09	.03	.06	.09	.16
.035	.06	.12	.03	.06	.12	.16
.042	.09	.12	.03	.06	.12	.19
.050	.09	.16	.06	.09	.16	.19
.062	.12	.19	.06	.09	.16	.25
.078	.16	.25	.09	.12	.19	.31
.093	.19	.31	.12	.16	.25	.38
.109	.22	.38	.12	.19	.31	.44
.125	.25	.44	.16	.22	.38	.50
.156	.31	.50				
.188	.38	.62				
.250	.50	.75				

DRAWN	CAM 10-2	.56
CHECKED	ROBBINS 1	-1-56
APPROVED		
APPROVED		

STANDARD MINIMUM BEND RADII FOR CARBON STEEL & STEEL ALLOY 0° TO 90°

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A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

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MINIMUM FLANGE HEIGHTS FOR POWER BRAKE UP TO 48" LONG

MINIMUM FLANGE HEIGHT
(POWER BRAKE)

PARTS UP TO 48" LONG

MAT'L GAGE	BEND RADII												
	.03	.06	.09	.12	.16	.19	.22	.25	.28	.31	.38	.44	.50
.012	.19	.19	.22	.25	.31	.34	.37	.50	.56				
.016	.19	.19	.22	.25	.31	.34	.37	.50	.56	.64			
.020	.19	.19	.22	.25	.31	.34	.37	.50	.56	.64	.77		
.025	.19	.19	.22	.25	.31	.34	.37	.50	.56	.65	.77	.90	1.02
.032	.22	.22	.22	.25	.31	.37	.37	.50	.56	.65	.78	.90	1.03
.040	.22	.22	.25	.25	.31	.37	.50	.50	.62	.66	.79	.91	1.04
.051		.25	.25	.25	.31	.37	.50	.50	.62	.67	.80	.92	1.05
.064			.31	.31	.37	.37	.50	.50	.62	.68	.81	.93	1.06
.072				.37	.37	.37	.50	.50	.56	.62	.69	.82	1.07
.081					.50	.50	.50	.56	.56	.68	.70	.83	1.08
.091						.50	.50	.56	.56	.68	.71	.84	.96
.102							.50	.56	.62	.62	.68	.72	.85
.125								.56	.62	.62	.75	.75	.87
.156									.75	.81	.78	.90	1.03
.188											.87	.93	1.06
.250												1.12	1.18
													1.25

DRAWN	CASE 10-22-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

MINIMUM FLANGE HEIGHTS FOR POWER
BRAKE UP TO 48" LONGCONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGOTOOL FABRICATION
PROCEDURES
MANUAL

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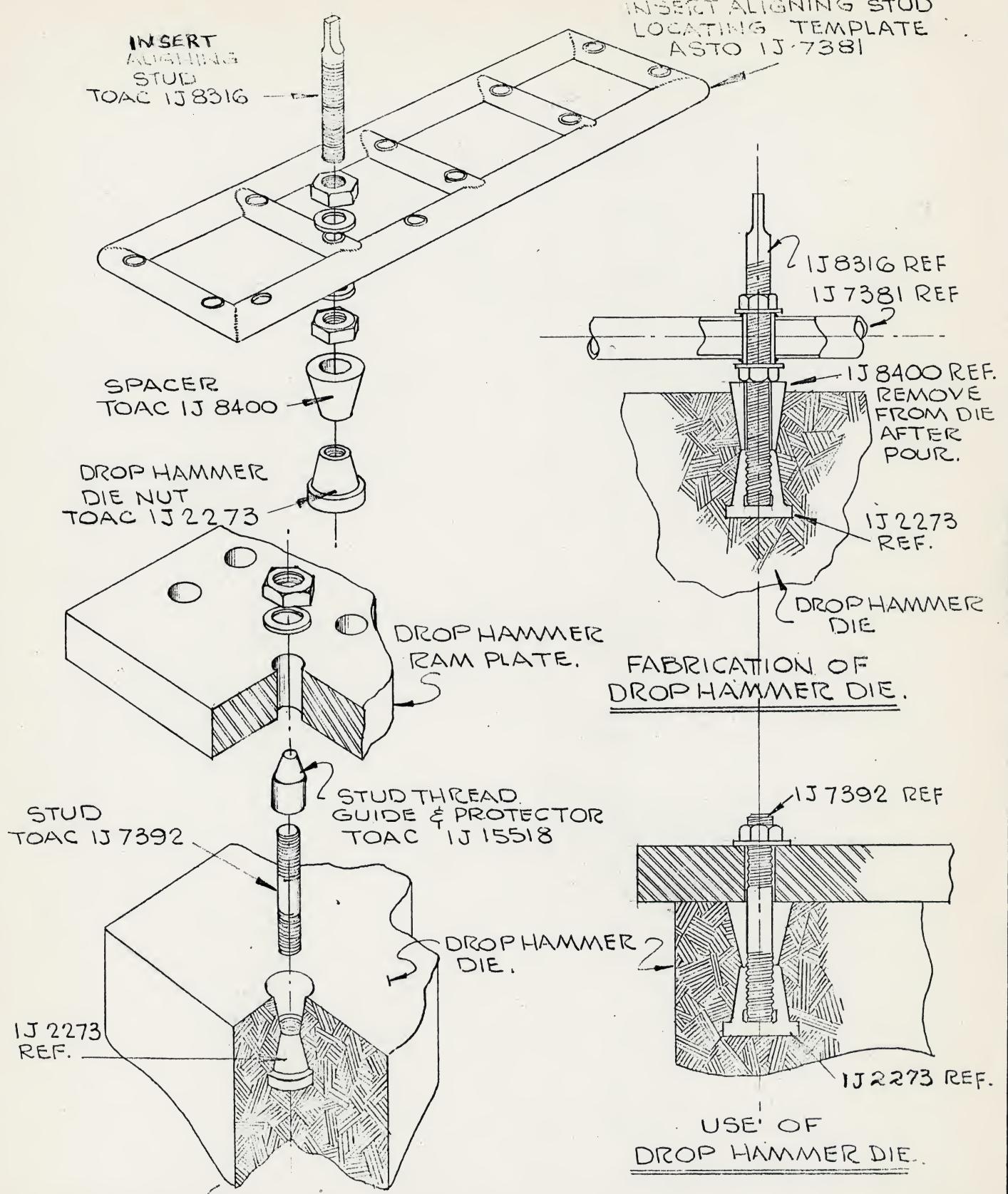
MINIMUM FLANGE HEIGHTS FOR POWER BRAKE PARTS 48" AND LONGER

MINIMUM FLANGE HEIGHT
(POWER BRAKE)

PARTS 48" AND LONGER

MAT'L GAGE	BEND RADII												
	.03	.06	.09	.12	.16	.19	.22	.25	.28	.31	.38	.44	.50
.012	.25	.25	.25	.31	.31	.34	.37	.50	.56				
.016	.25	.25	.25	.31	.31	.34	.37	.50	.56	.64			
.020	.25	.25	.25	.31	.31	.34	.37	.50	.56	.64	.77		
.025	.25	.25	.25	.31	.31	.34	.37	.50	.56	.65	.77	.90	1.02
.032		.25	.25	.31	.37	.37	.37	.50	.56	.65	.78	.90	1.03
.040		.31	.31	.31	.37	.37	.50	.50	.62	.66	.79	.91	1.04
.051		.31	.31	.37	.37	.37	.50	.50	.62	.67	.80	.92	1.05
.064			.37	.37	.50	.37	.50	.50	.62	.68	.81	.93	1.06
.072				.37	.50	.50	.50	.56	.62	.69	.82	.94	1.07
.081					.50	.56	.50	.56	.56	.68	.70	.83	.95
.091						.50	.56	.56	.56	.68	.71	.84	.96
.102							.62	.56	.62	.62	.68	.72	.85
.125								.62	.62	.62	.75	.75	.87
.156									.75	.81	.78	.90	1.03
.188											.87	.93	1.06
.250												1.12	1.18
													1.25

DRAWN	CAME 10-22-56	* MINIMUM FLANGE HEIGHTS FOR POWER BRAKE PARTS 48" AND LONGER	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 10-25-56			PAGE 105
APPROVED				
APPROVED				

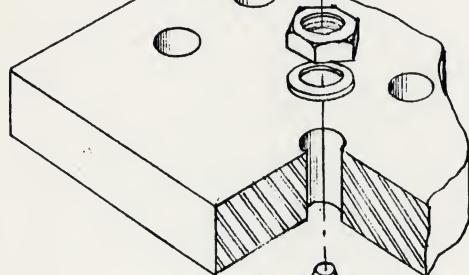


INSERT ALIGNING STUD
TOAC IJ 8316

INSERT ALIGNING STUD LOCATING TEMPLATE
ASTO IJ-7381

SPACER
TOAC IJ 8400

DROP HAMMER
DIE NUT
TOAC IJ 2273



DROP HAMMER RAM PLATE.

STUD
TOAC IJ 7392

STUD THREAD
GUIDE & PROTECTOR
TOAC IJ 15518

IJ 2273
REF.

DROPHAMMER DIE.

IJ 7392 REF

IJ 2273 REF.

USE OF
DROP HAMMER DIE.

DRAWN BY: ELLIOTT 2-14-55

CHECKED

APPROVED

ACCESSORY TOOLS-DROP HAMMER
DIE FABRICATION

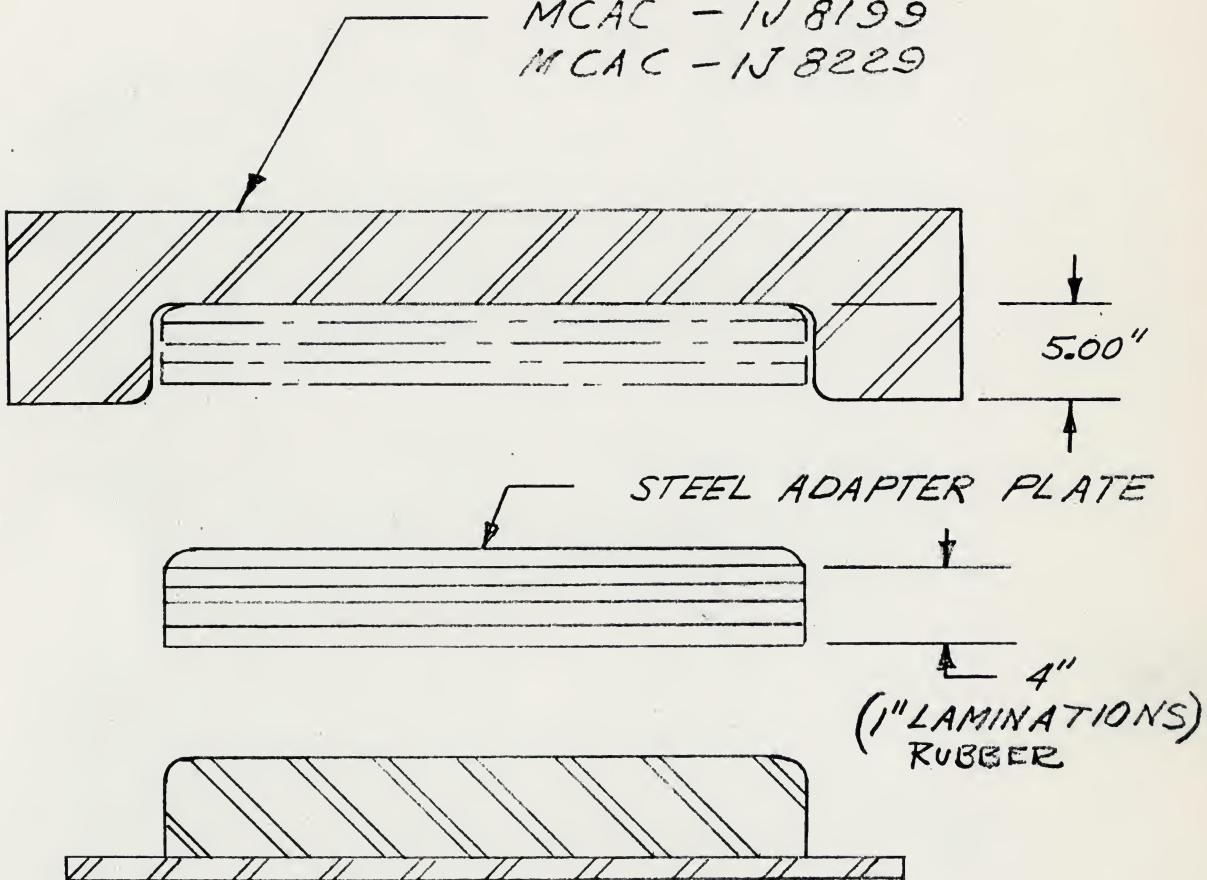
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SAN DIEGO DIVISION . . SAN DIEGO, CALIFORNIA

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MCAC - 1V8199
MCAC - 1J8229



SEE TUBE FILE FOR WORKING DRAWING

DRAWN	CAME 10-25-56	DROP HAMMER DIE TRAPPED RUBBER FORMING	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 11-1-56		
APPROVED			
APPROVED			
		CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	PAGE 107

MAINTENANCE PROCEDURE - TRAPPED RUBBER FORMING DIES

SMALL DIE -

DIE NO. : MCAC - 1J8199 (18 INCH DIA.)
RUBBER : CVAC # RU1015-15 (1" THICK, 80 SHORE, CUT TO SIZE)

MEDIUM DIE -

DIE NO. : MCAC - 1J8554 (16 X 34 OBLONG)
RUBBER : CVAC #

LARGE DIE -

DIE NO. : MCAC 1J8229 (24 X 36 OBLONG)
RUBBER : CVAC # RU1015-20 (1" THICK, 80 SHORE, CUT TO SIZE)

ALL DIES -

CLEANER : CVAC # SOL 1-2 (M.E.K.)
CEMENT : CVAC # CEM 1000-6 (FLINT-KOTE #974)

NO SUBSTITUTE MAY BE USED FOR ANY OF THE ABOVE MATERIALS, WITHOUT TOOL DESIGN APPROVAL.

A. TO BUILD UP A COMPLETE RUBBER DIE PAD ASSEMBLY, THE FOLLOWING PROCEDURE MUST BE ADHERED TO.

1. THE DIE PAD ADAPTER PLATE IS TO BE FREE OF ALL TRACES OF OLD RUBBER, CLEAN BY SAND BLASTING. CHECK PLATE FOR FLATNESS, PLATE MUST BE FLAT WITHIN .030.
2. CLEAN PLATE BY WASHING WITH CVAC #SOL 1-2. DO NOT TOUCH CLEANED SURFACE WITH FINGERS OR ANY THING WHICH MIGHT LEAVE AN OILY RESIDUE ON SURFACE.
3. DISC GRIND ONE FACE OF ONE PIECE OF CVAC #RU1015-TO SUIT USING 80 TO 100 GRIT ABRASIVE. BRUSH FREE OF GRINDING DUST AND THOROUGHLY CLEAN WITH SOL 1-2. DO NOT TOUCH AFTER CLEANING.
4. AFTER SURFACES OF ADAPTER PLATE AND RUBBER LAMINATE ARE DRY, APPLY ONE BRUSH COAT OF CEM 1000-6 TO CLEANED SURFACES MAKING SURE TO FULLY COVER SURFACES. BRUSH COAT THICKNESS WILL AVERAGE 0.010 - 0.016 INCHES.
5. AFTER 20 MINUTES APPLY SECOND COAT TO BOTH SURFACES.

DRAWN	CAME 10-26-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

DROP HAMMER DIE
TRAPPED RUBBER FORMING

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6. AIR DRY UNTIL COATED SURFACES ARE DEFINITELY TACKY, APPROXIMATELY ONE HOUR.
 7. PRESS SURFACES FIRMLY TOGETHER TO INSURE CONTACT AT ALL POINTS, BUT DO NOT FORCE CEMENT OUT OF JOINTS, MAINTAIN UNIFORM PRESSURE FOR AT LEAST TWO (2) HOURS TO PROMOTE BETTER ADHESION.
 8. AFTER REMOVING PRESSURE, AVOID ROUGH HANDLING FOR AT LEAST 24 HOURS.
 9. AFTER 24 HOURS WAITING PERIOD, PREPARE BOTH SIDES OF ADDITIONAL RUBBER LAMINATES, FOLLOWING THE SAME PROCEDURES OUTLINED IN STEPS 3, 4, 5, 6, 7 & 8.
- B. TO REPLACE ONLY THE OUTSIDE LAMINATE, USE THE FOLLOWING PROCEDURE:
1. REMOVE COMPLETE POD ADDEMBLY FROM DIE.
 2. PLANE OFF THE AMOUNT OF RUBBER REQUIRED TO REMOVE DAMAGE, WORK IN INCREMENTS OF ONE INCH.
 3. GRIND SURFACE, USING 80-100 GRIT ABRASIVE. BRUSH FREE OF GRINDING DUST AND THOROUGHLY CLEAN AS OUTLINED IN PRECEDING STEPS.
 4. PREPARE REPLACEMENT LAMINATE AND PROCEED AS OUTLINED IN A3 THRU A8.

DRAWN	CAME 10-24-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

DROP HAMMER DIE
TRAPPED RUBBER FORMING

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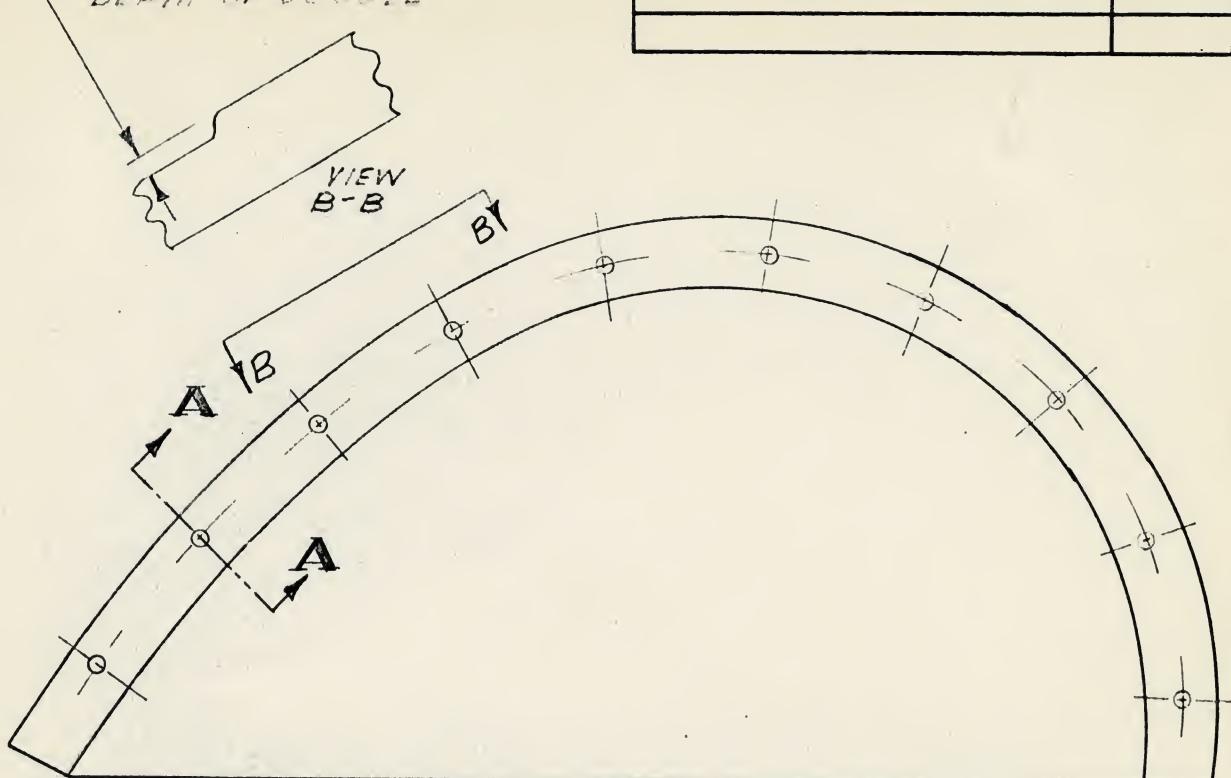
PAGE 109

.010 OVER NOM.
DEPTH OF JOGGER

ALTERATION

DATE

NAME



NOTE: USE BOLTS AND PINS
FOR TIE DOWN OF BLOCK TO
BASE. DOWEL PIN HOLES
ARE NOT TO BE DRILLED
THROUGH FORM BLOCK.

LOCATING PINS $\frac{3}{16}$ SLIP FIT (CVAC WILL
FURNISH PINS)

ALLOW FOR SPRING BACK

.25 MIN

SECT. A-A

SMALL & NARROW BLOCKS
NEED SOLID BASE PLATES

NOTE:

1. FOR BEAD FORMS & TOOLS SEE HYDRO-PRESS STANDARD TOOL BOOK.
2. HYDRO-PRESS BEAD FORMS AND CUTTING RINGS WILL BE INSTALLED
ON THE HPFM'S BY CONVAIR.

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	

HYDRO-PRESS FORM BLOCKS (TYP. ILLUSTRATIONS)

TOOL FABRICATION

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STEEL BEAD FORMS

DURAL BASE
OR HI'DEN



.25 MIN-
ALL
HPFM

ILLUSTRATION - 1

HYDRO-PRESS CUTTING RINGS

DURAL BASE
OR HI'DEN



ILLUSTRATION - 2

HYDRO-PRESS CUTTING RINGS

DURAL BASE
OR HI'DEN



ILLUSTRATION - 3

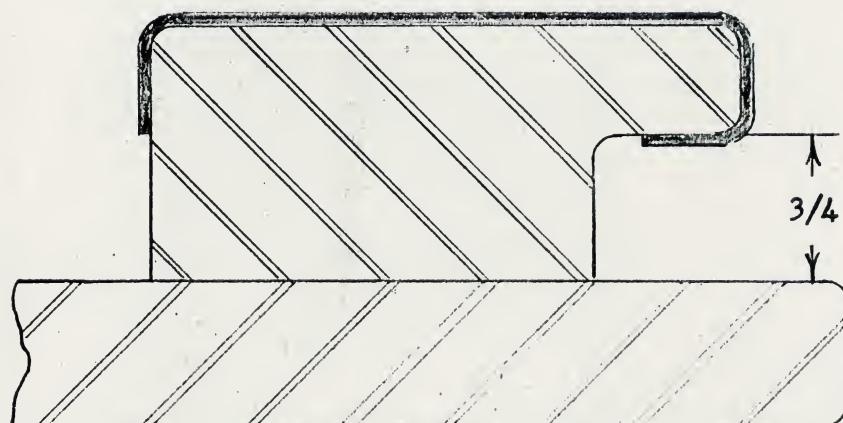
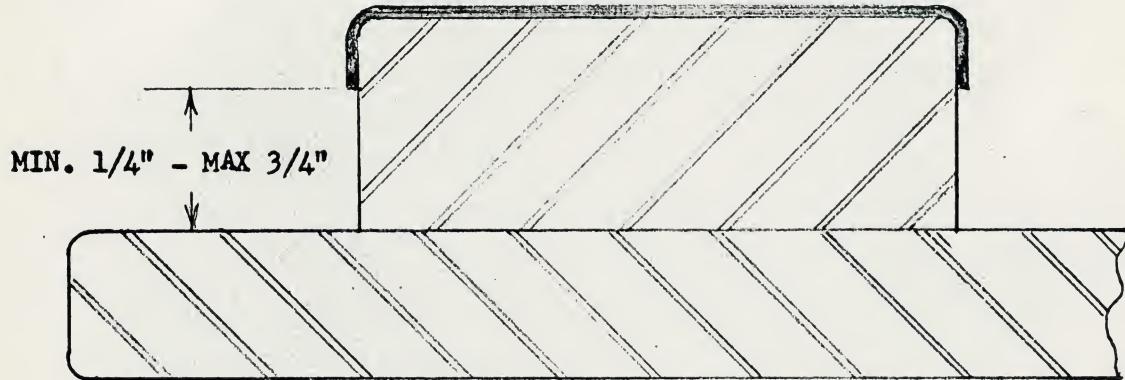
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

**HYDRO-PRESS FORM BLOCKS
(TYPICAL ILLUSTRATIONS)**

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

TOOL FABRICATION PROCEDURES MANUAL

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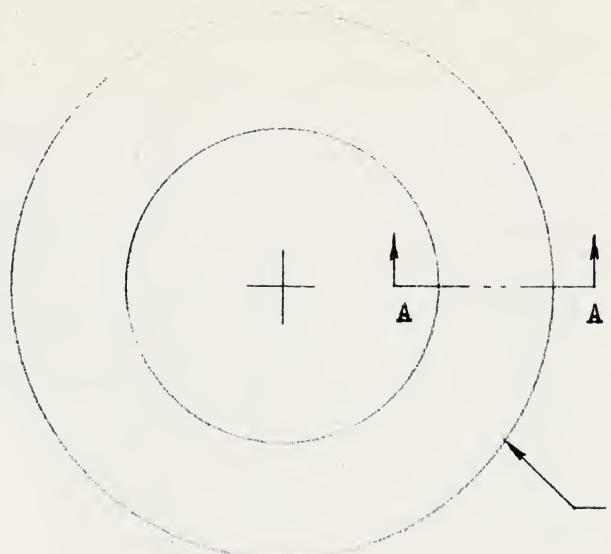
DRAWN	<i>Samuels</i>	10/10/60
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

BLOCK - FOR HYDRO-PRESS

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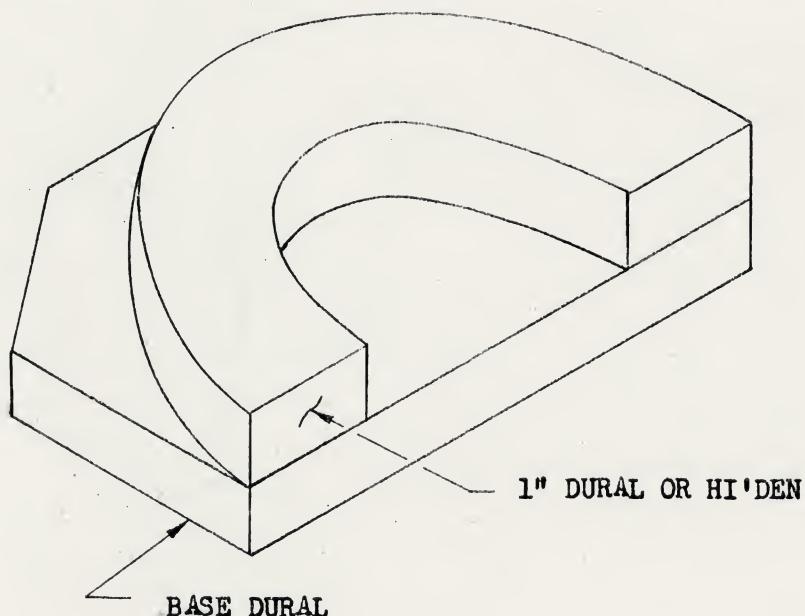
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SECT. A-A

DURAL OR HI'DEN
1" MIN. THICKNESS

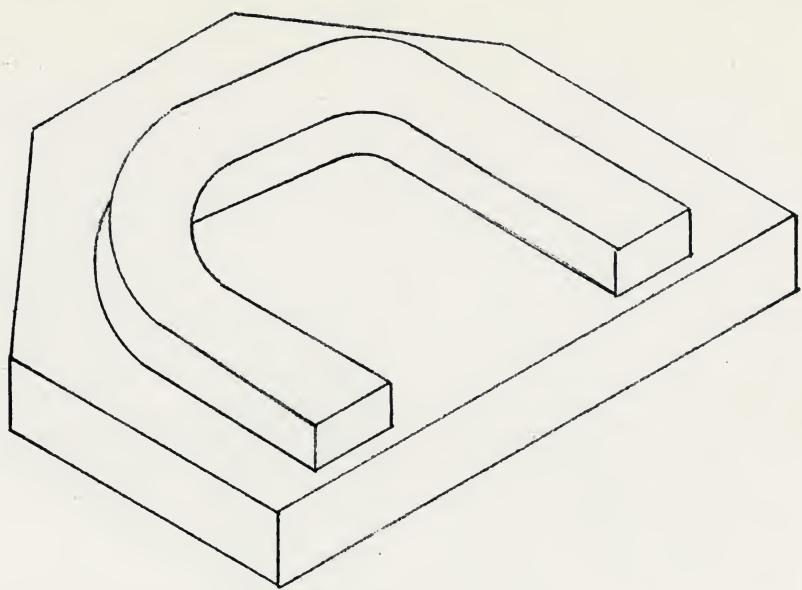
NO BASE REQUIRED



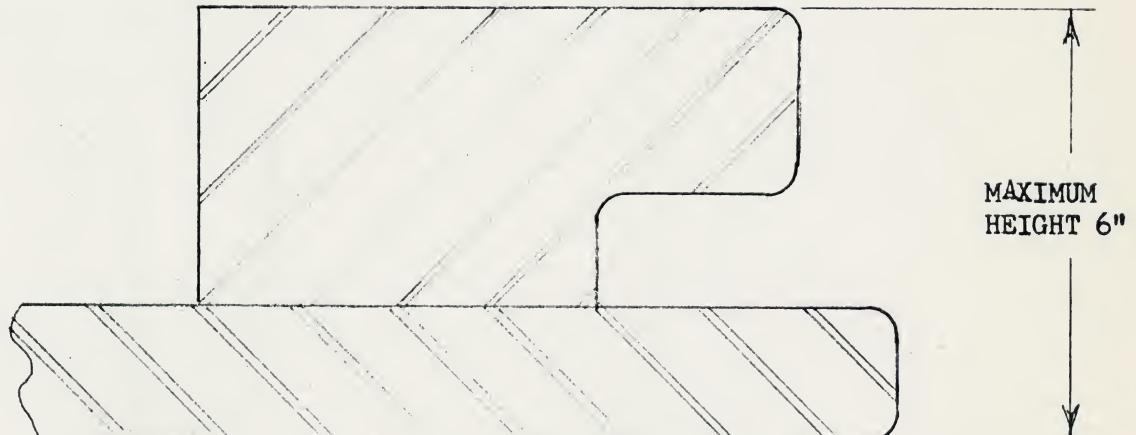
DRAWN	CAME 10-26-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

BLOCK - FOR HYDRO-PRESS
CONVAIR
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BASE REQUIRED DURAL

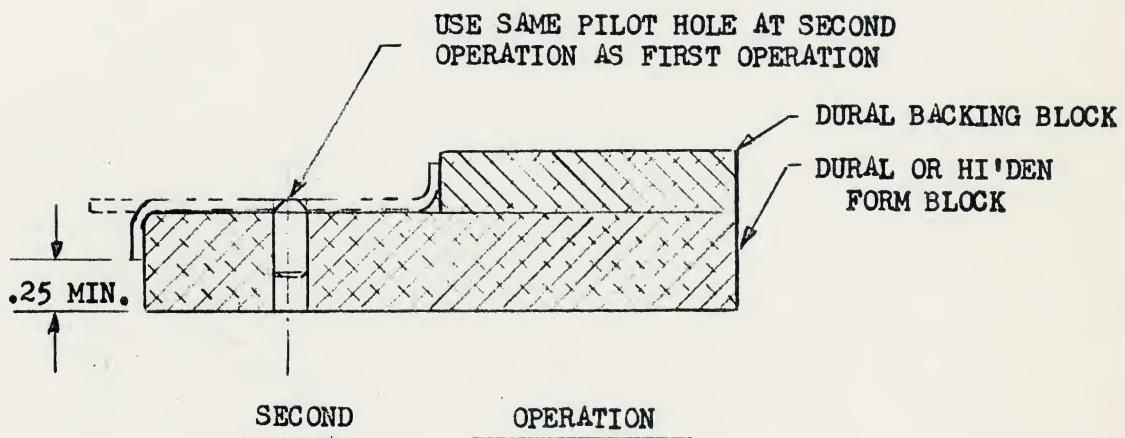
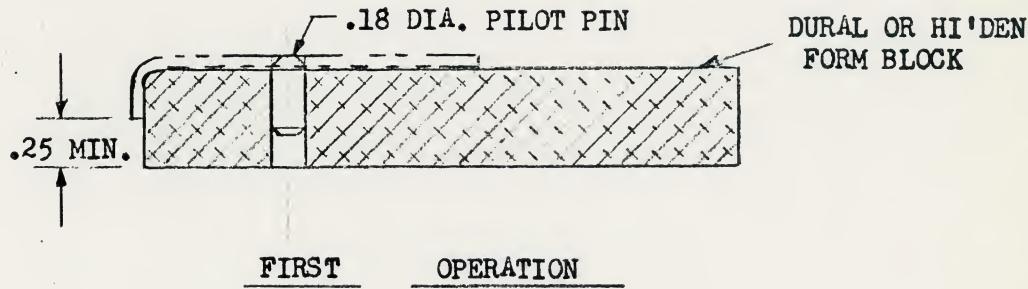


4" MAXIMUM HEIGHT FOR
SMALL PRESSES

DRAWN	CAME 10-26-56	
CHECKED	ROBBINS 11-1-56	
APPROVED		
APPROVED		

BLOCK - FOR HYDRO-PRESS
CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

TOOL FABRICATION
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MANUAL
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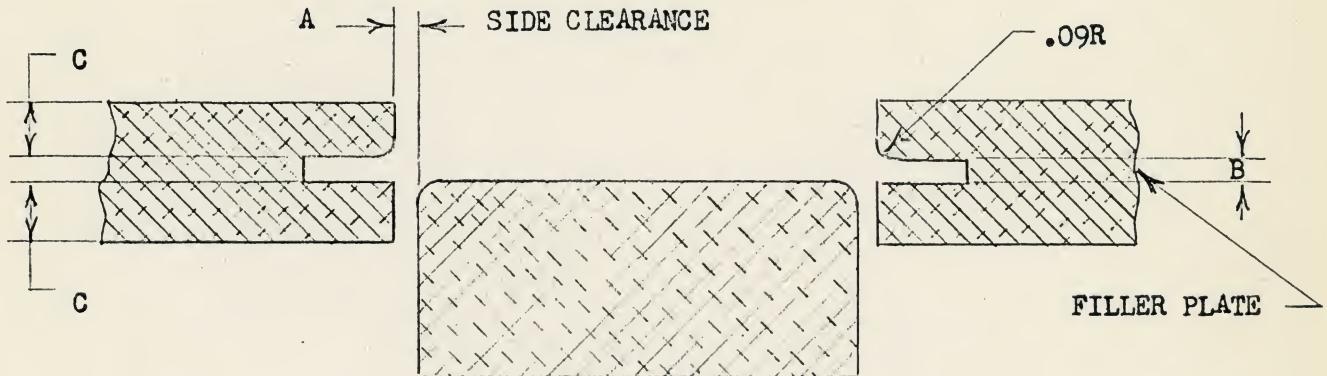
DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

SECTION FORMED - TWO OPERATION BLOCK

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HPPM (REF.)

A = PART THICKNESS + .003

B = PART THICKNESS + .008 TO + .010

C = .25 FOR MATERIAL UP TO .040
 .31 FOR MATERIAL .040 TO .052
 .37 FOR MATERIAL .052 TO .064

NOTES:

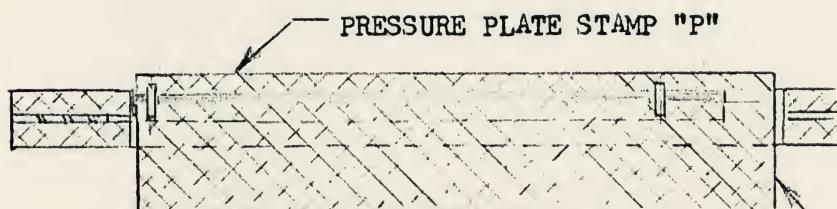
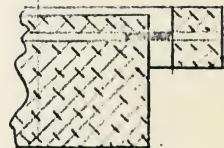
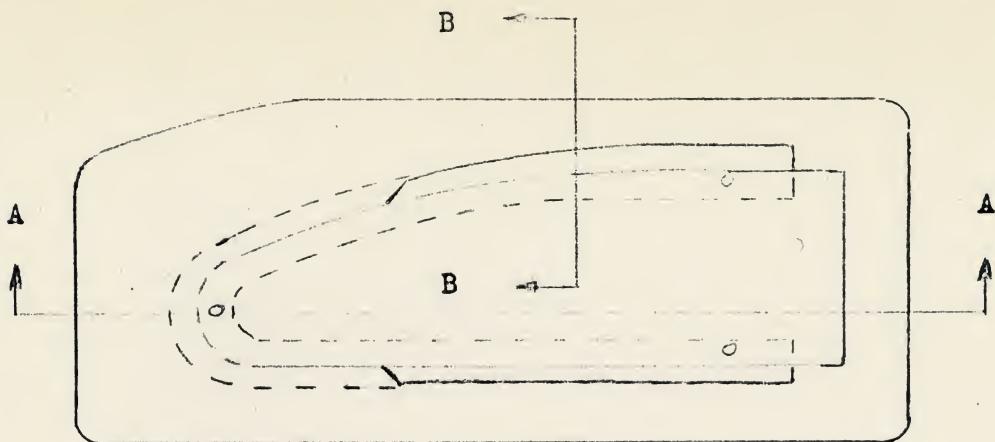
1. USE AND DESIGN OF SHRINK CLIP TO BE LEFT TO DISCRETION OF DEPT. 406-2.
2. IF SHRINK CLIP IS USED, THE HPPM SHOULD BE STAMPED "P-2" AND THE CLIP "P".

DRAWN	GAM 10-26-56	
CHECKED	ROBBINS 11-1-56	
APPROVED		
APPROVED		

AUXILIARY SHRINK CLIP FOR USE
 WITH HYDRO-PRESS FORM BLOCK

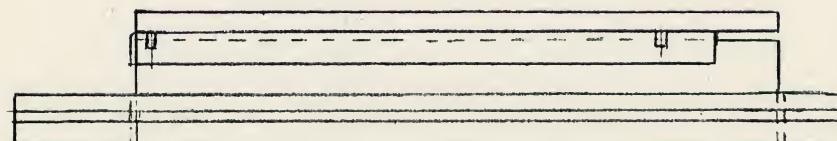
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SECTION B-B
(LOADED)

HPFM
STAMP "P 3"



SHRINK CLIP
STAMP "P"

HPFM OPERATION COMPLETE

SHRINK CLIP TO BE USED ONLY ON PARTS WITH SHARP RADIUS AS
SHOWN ABOVE. DEPT 406-2 TO DETERMINE WHEN USED.

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ILLUSTRATION SHOWING USE OF "HPFM"
SHRINK CLIP

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NOTE:

FOR ALL FORMING ON 2024-0 AL. AL. USE 2° SPRING BACK
ALSO USED FOR 7075-0 AL. AL.

MAT'L GAGE	2024-T4 (ALUMINUM ALLOY)						
	R A D I U S						
	1/16	3/32	1/8	5/32	3/16	7/32	1/4
DEGREES OF SPRING BACK							
.018	9	10	13	14-1/2	18	18	20
.020	8-1/2	9-1/2	12-1/2	13-1/2	14-1/2	17	19
.025	8	9	11	12	13	15-1/2	16-1/2
.032	7	8	10	11	11-1/2	13-1/2	14-1/2
.036	6-1/2	7-1/2	9-1/2	10-1/2	11	12-1/2	13
.040	6	7	9	10	10	12	12
.051	5	6	8	9	9	10	10
.064	4	6	7	8	8	9	9
.072	3	5-1/2	6-1/2	7-1/2	8	8-1/2	9

DRAWN	CAME	10-15-56	SPRING BACK ALLOWANCE FOR 2024-T4 (ALUMINUM ALLOY) FOR HYDRO-PRESS FORMING	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION
CHECKED	ROBBINS	10-20-56			PROCEDURES
APPROVED					MANUAL
APPROVED					PAGE 126

	COR-RES STEEL 57-136-9B SOFT						
MAT'L GAGE	R A D I U S						
	1/16	3/32	1/8	5/32	3/16	7/32	1/4
DEGREES OF SPRING BACK							
.018	4 1/2	5 1/2	6 1/2	7 1/2	8 1/2	9	9 1/2
.020	4 1/2	5	6 1/2	7 1/2	8	9	9 1/2
.025	4	5	6	7	8	8 1/2	9
.032	3	4	5	6	7	7 1/2	8
.036	3	4	5	6	6 1/2	7	7 1/2
.040	2 1/2	3 1/2	4 1/2	5	6	6 1/2	7
.051		3	3 1/2	4 1/2	5	5 1/2	6
.064			3	3 1/2	4 1/2	5	5 1/2
.072				3	4	4 1/2	5

DRAWN	CAME 10-15-56	SPRING BACK ALLOWANCE FOR COR-RES STEEL 57-136-9B SOFT FOR HYDRO-PRESS FORMING	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 10-20-56		
APPROVED			
APPROVED			
		CONVAIR <small>A DIVISION OF GENERAL DYNAMICS CORPORATION</small> <small>SAN DIEGO</small>	PAGE 127

COR-RES STEEL 11068 1/4 HARD							
MAT'L GAGE	R A D I U S						
	1/16	3/32	1/8	5/32	3/16	7/32	1/4
DEGREES OF SPRING BACK							
.018	9-1/2	13	17	19	21	23	23-1/2
.020	9-1/2	13	15-1/2	17-1/2	19-1/2	21	23
.025	7-1/2	11-1/2	13-1/2	16	17	19-1/2	21
.032	5-1/2	11-1/2	13	15	15-1/2	17-1/2	19
.036		10-1/2	12-1/2	14-1/2	15	16	17
.040		10	11-1/2	13-1/2	14	15	16
.051			10-1/2	11-1/2	12-1/2	13-1/2	15
.064			10	10-1/2	11-1/2	12-1/2	13-1/2
.072				10	10-1/2	11-1/2	12-1/2

DRAWN	CAME 10-15-56	SPRING BACK ALLOWANCE FOR COR-RES STEEL 11068 1/4 HARD FOR HYDRO-PRESS FORMING	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 10-20-56		
APPROVED			
APPROVED			
CONVAIR <small>A DIVISION OF GENERAL DYNAMICS CORPORATION</small> <small>SAN DIEGO</small>		PAGE 128	

	COR-RES STEEL 11068-A 1/2 HARD						
MAT'L GAGE	R A D I U S						
	1/16	3/32	1/8	5/32	3/16	7/32	1/4
DEGREES OF SPRING BACK							
.018	12	15	18-1/2	24	24-1/2	27-1/2	30
.020	12	15	18	21-1/2	24	27	27-1/2
.025	12	12-1/2	18	21	21-1/2	24-1/2	24-1/2
.032	9-1/2	12	15	18	18-1/2	21	21-1/2
.036	9-1/2	12	15	15-1/2	18	18-1/2	21
.040	9	9-1/2	12-1/2	15	15-1/2	18	18-1/2
.051			12	14	14-1/2	17	17
.064			11	12-1/2	13	13-1/2	15-1/2
.072				11	12	12-1/2	14

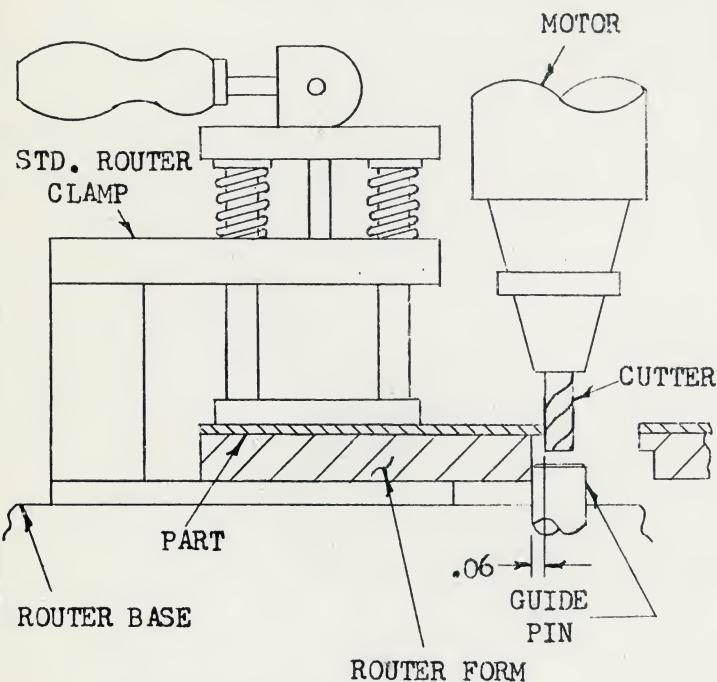
DRAWN	CAME	10-15-56
CHECKED	ROBBINS	10-20-56
APPROVED		
APPROVED		

SPRING BACK ALLOWANCE FOR COR-RES STEEL
11068-A 1/2 HARD FOR HYDRO-PRESS FORMING

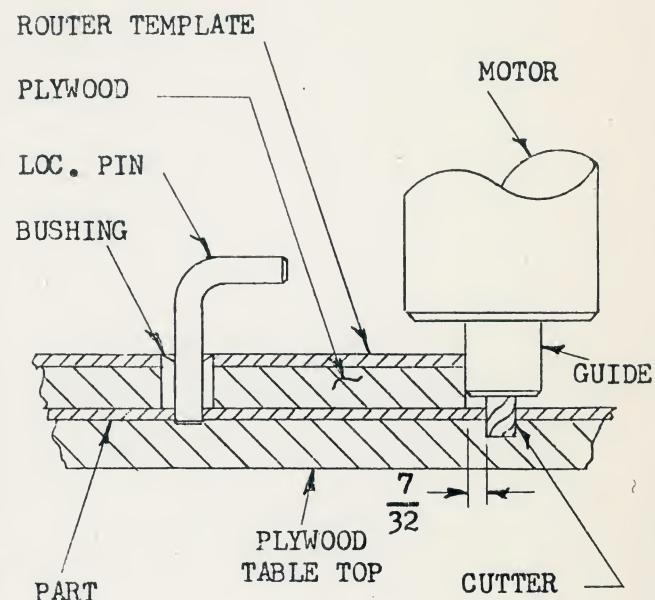
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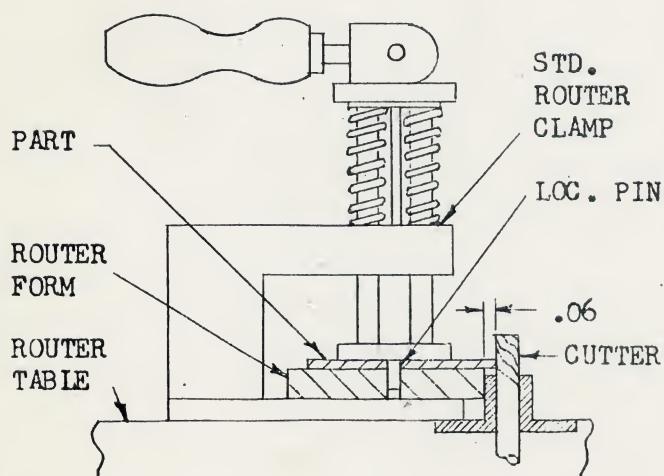
PRINCIPLE OF OVERHEAD PIN ROUTER



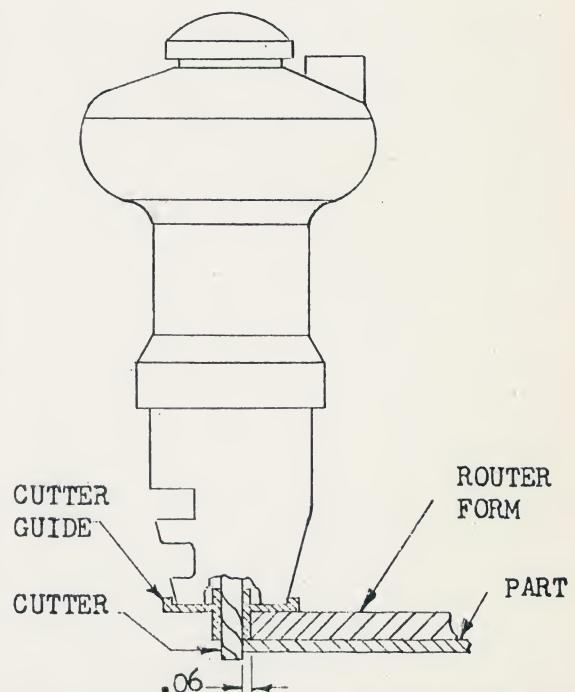
PRINCIPLES OF RADIAL ARM ROUTER



PRINCIPLE OF TABLE ROUTER



PRINCIPLES OF PORTABLE ROUTER



DRAWN	STICKELMAN	1-9-57
CHECKED	ROBBINS	
APPROVED		
APPROVED		

PRINCIPLES OF OVERHEAD PIN,
RADIAL ARM, TABLE & PORTABLE ROUTERS

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SHAPER ROUTING

THIS METHOD OF ROUTING CONSISTS OF A FIXED POSITION ROUTING CUTTER IN THE CENTER OF A TABLE WITH PERIMETERS CONTROLLED BY A ROUTER FORM (RTFM).

THIS MACHINE IS NOT ADAPTABLE TO INTERNAL PERIPHERY ROUTING UNLESS A 3/4" HOLE IS PUNCHED WITHIN THE INTERNAL PERIPHERY. WHERE INTERNAL PERIPHERIES EXCEED MAXIMUM MATERIAL DIMENSIONS FOR PIN ROUTER, THE PLANNING SHALL CALL FOR PUNCHING THE REQUIRED 3/4" STARTING HOLE.

ROUTER FORMS SHOULD BE PLANNED TO LOCATE STOCK BY MEANS OF LOCATING PINS.

WHERE A FORMED PART IS TO BE ROUTED, DRILL BUSHINGS MAY BE ORDERED IN A RTFM FOR TOOLING PIN LOCATION, A TOTP FOR HOLE LOCATION SHOULD BE ORDERED.

A SET BACK OF .062 IS TO BE INCORPORATED IN RTFM TO COMPENSATE FOR DIFFERENCE IN DIAMETER OF BUSHING AND CUTTER.

OVERHEAD OR PIN ROUTING

THIS METHOD CONSISTS OF A FIXED POSITION ROUTING CUTTER WHERE THE INTERNAL PERIMETERS ARE CONTROLLED BY THE BOTTOM EDGE OF THE ROUTER FORM AND A PIN IN THE TABLE OF THE ROUTING TABLE.

THIS ROUTER MAY BE USED FOR PREPARATION OF BLANKS FOR TRIMMING AFTER FORMING, PROVIDED THE STOCK SIZES DO NOT EXCEED THE MINIMUM SIZES FOR RADIAL ROUTER.

THIS SYSTEM DOES NOT REQUIRE A STARTING HOLE IN THE PART. THE ROUTER CUTTER IS USED AS A DRILL.

A SET BACK OF .062 IS TO BE INCORPORATED IN RTFM TO COMPENSATE FOR DIFFERENCE IN DIAMETERS OF GUIDE PIN AND ROUTER CUTTERS. (THIS DIFFERENCE IS MAINTAINED SO RTFM SET-BACK WILL BE SAME FOR SHAPER AND PIN-ROUTING).

PORTABLE ROUTERS

THIS METHOD USES A PORTABLE ROUTER GUIDED BY HAND FOLLOWING A ROUTER FORM (RTFM) OR TRIM SHELL (TRSH). THIS METHOD IS USED FOR ROUTING CONTOURED PARTS THAT CANNOT BE DONE ON A MACHINE AND IS ALSO USED FOR TRIMMING OPERATIONS ON ASSEMBLIES.

NOSE PIECE OF ROUTER CARRIES A BUSHING WITH CUTTER GOING THROUGH BUSHING. O.D. OF BUSHING ACTS AS A FOLLOWER ON RTFM OR TRSH WHICH HAVE AN .062 SET BACK INCORPORATED IN THEM TO COMPENSATE FOR DIFFERENCE IN DIAMETER OF CUTTER AND BUSHING.

RADIAL ARM ROUTER

THIS METHOD USES ROUTER MOTOR CARRIED ON A JOINTED RADIAL ARM. A NOSE PIECE ATTACHED TO MOTOR CARRIES A BUSHING WHICH RIDES AGAINST ROUTER TEMPLATE (RTTP) SPACED ABOVE PARTS BEING ROUTED BY PLYWOOD SEPARATOR. ROUTER CUTTER GOES THRU GUIDE BUSHING AND AN OFFSET OF 7/32 IS USED ON THIS TYPE ROUTING TO COMPENSATE FOR DIFFERENCE IN DIAMETER OF BUSHING AND CUTTER.

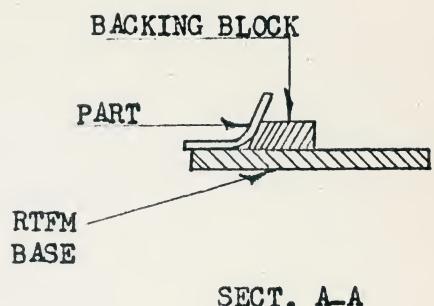
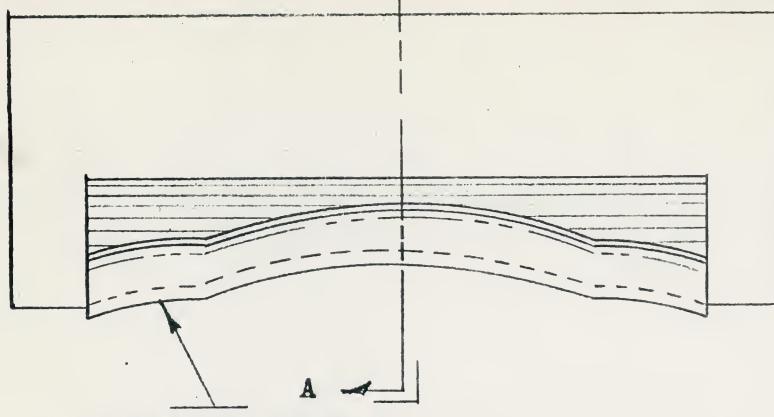
THIS METHOD IS USED ON LARGE PARTS NOT LESS THAN 4.0 WIDE AND NOT LESS THAN 100.0 TOTAL EXTERNAL PERIMETER AND CAN ALSO BE USED TO ROUT CUT-OUTS.

NOTE: ALL ROUTER FORMS TO HAVE PERIPHERY WITNESS STAMPED BY TOOL INSPECTION.

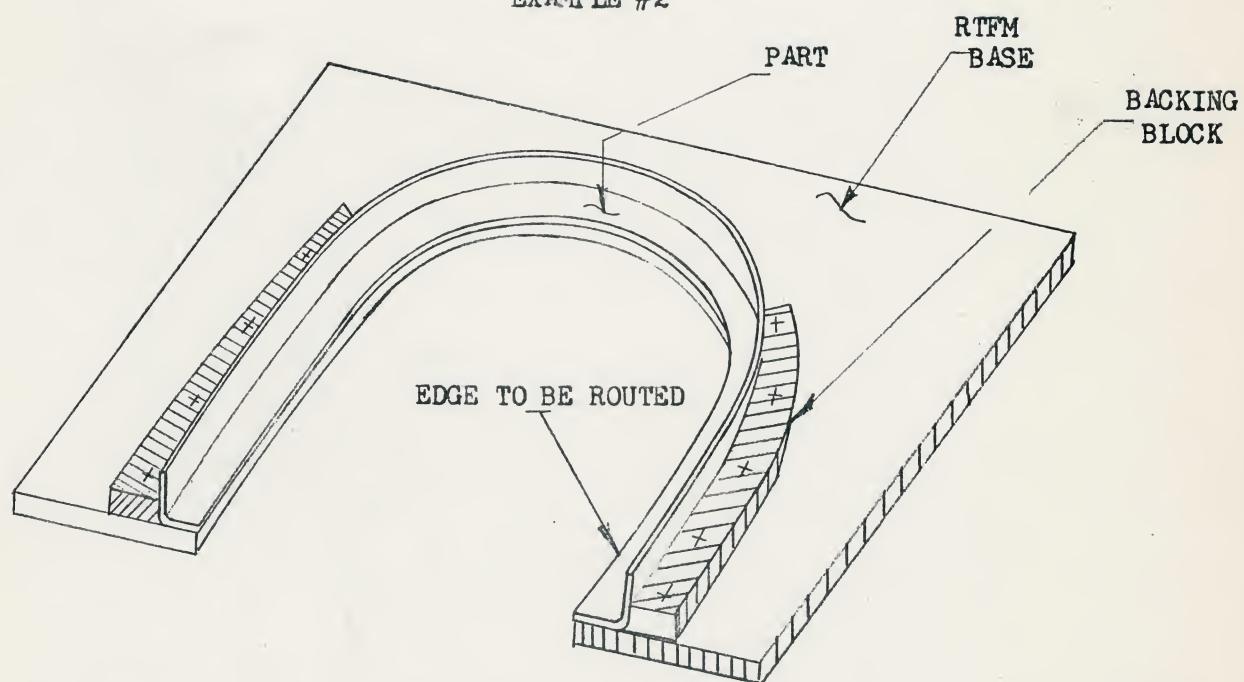
DRAWN	CAME 10-26-56	ROUTER FORMS	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS		
APPROVED			
APPROVED		CONVAIR <small>A DIVISION OF GENERAL DYNAMICS CORPORATION</small>	PAGE 134

A - - -

EXAMPLE #1



EXAMPLE #2



PROVIDE BACKING BLOCK ON RTFM'S TO GIVE MORE POSITIVE
LOCATION AND ADDED SUPPORT AND RIGIDITY TO THE PART
DURING THE ROUTING OPERATION.

MAKE BLOCK OF HARDWOOD OR CAST DURAL.

DRAWN	CAME 10-26-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

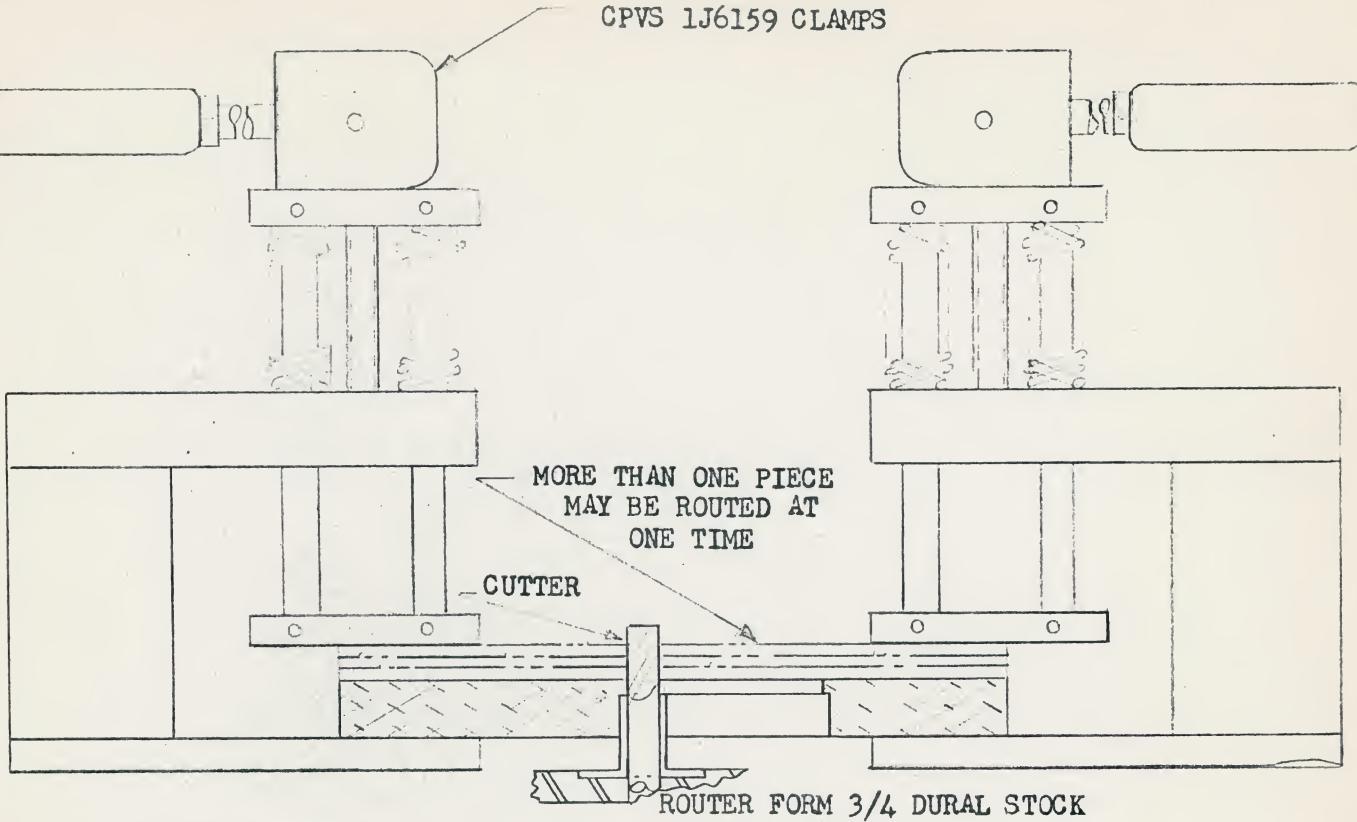
ROUTER FORM "RTFM"
TOOL ILLUSTRATION

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SAN DIEGO

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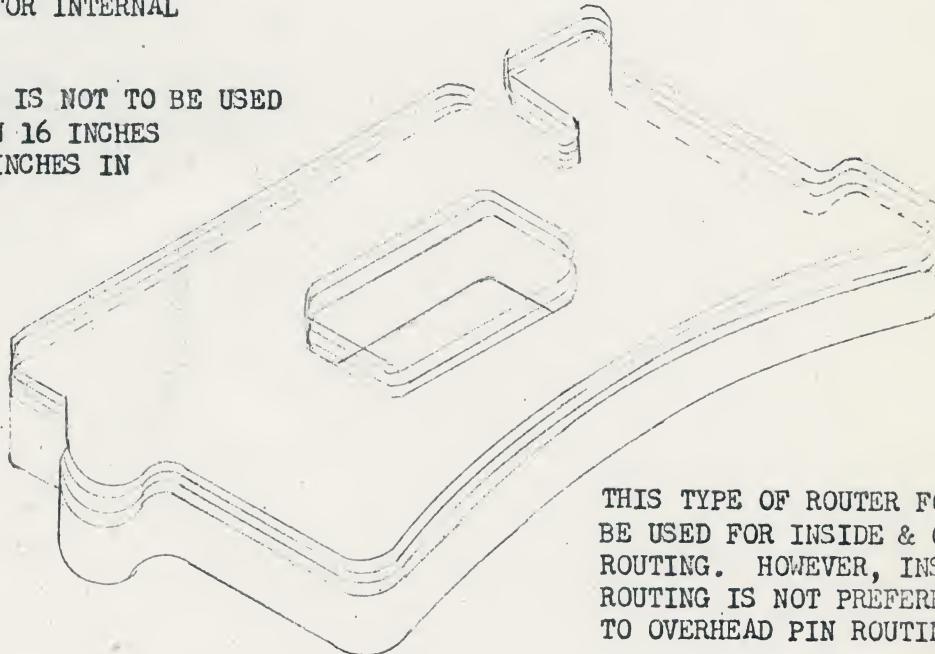
PAGE 135

CPVS 1J6159 CLAMPS



A 3/4 HOLE MUST BE PROVIDED
AS STARTING HOLE FOR INTERNAL
PERIMETER.

NOTE: 1. THIS TOOL IS NOT TO BE USED
ON PARTS LESS THAN 16 INCHES
OR MORE THAN 100 INCHES IN
PERIMETER.



THIS TYPE OF ROUTER FORM MAY
BE USED FOR INSIDE & OUTSIDE
ROUTING. HOWEVER, INSIDE
ROUTING IS NOT PREFERRED (REF.
TO OVERHEAD PIN ROUTING).

TYPICAL ROUTER FORM

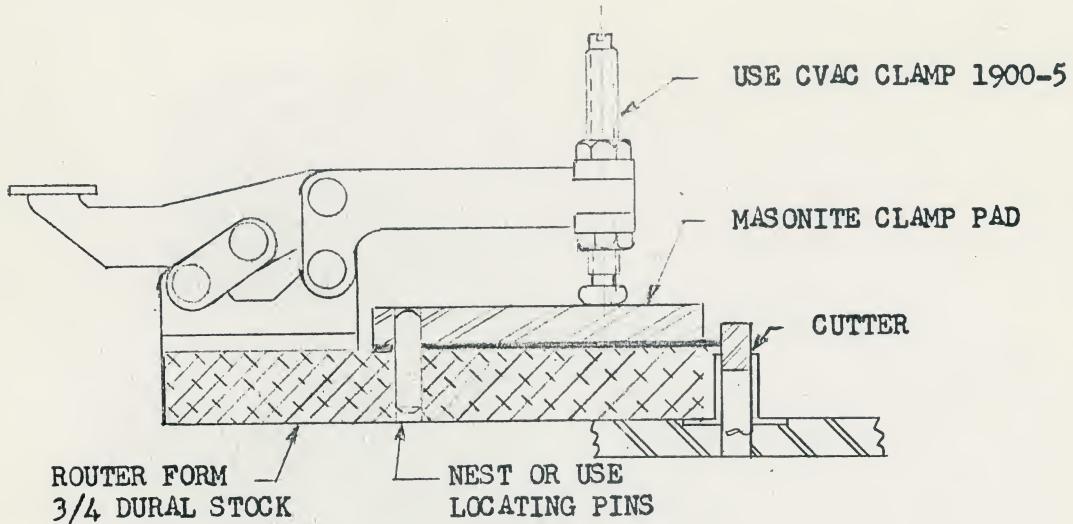
DRAWN	CAME 10-29-56	
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

ROUTER FORM - STACK ROUTING
USED ON SHAPER

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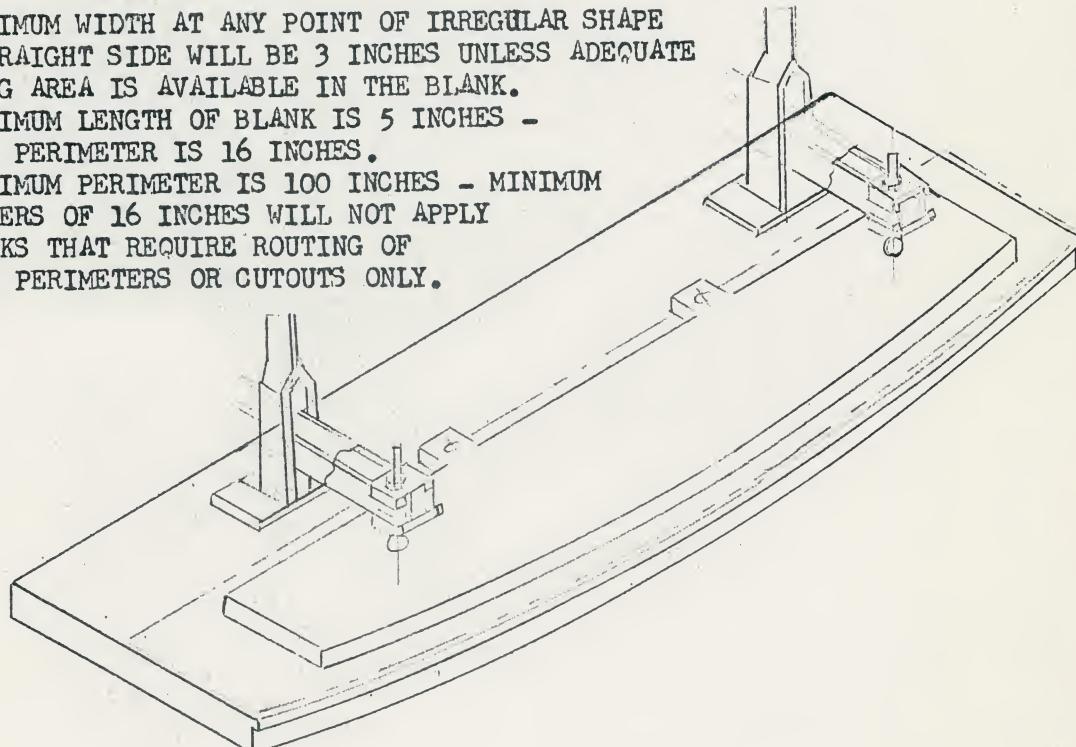


NOTE:

1. MINIMUM WIDTH AT ANY POINT OF IRREGULAR SHAPE TO A STRAIGHT SIDE WILL BE 3 INCHES UNLESS ADEQUATE CLAMPING AREA IS AVAILABLE IN THE BLANK.

MINIMUM LENGTH OF BLANK IS 5 INCHES -
MINIMUM PERIMETER IS 16 INCHES.

MAXIMUM PERIMETER IS 100 INCHES - MINIMUM PERIMETERS OF 16 INCHES WILL NOT APPLY TO BLANKS THAT REQUIRE ROUTING OF PARTIAL PERIMETERS OR CUTOUTS ONLY.



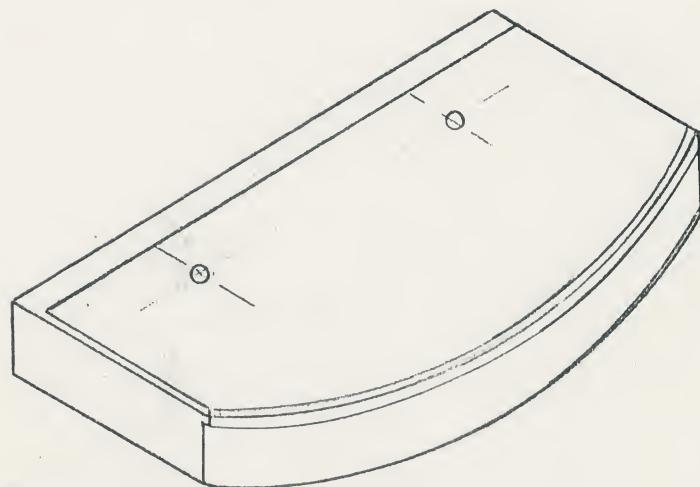
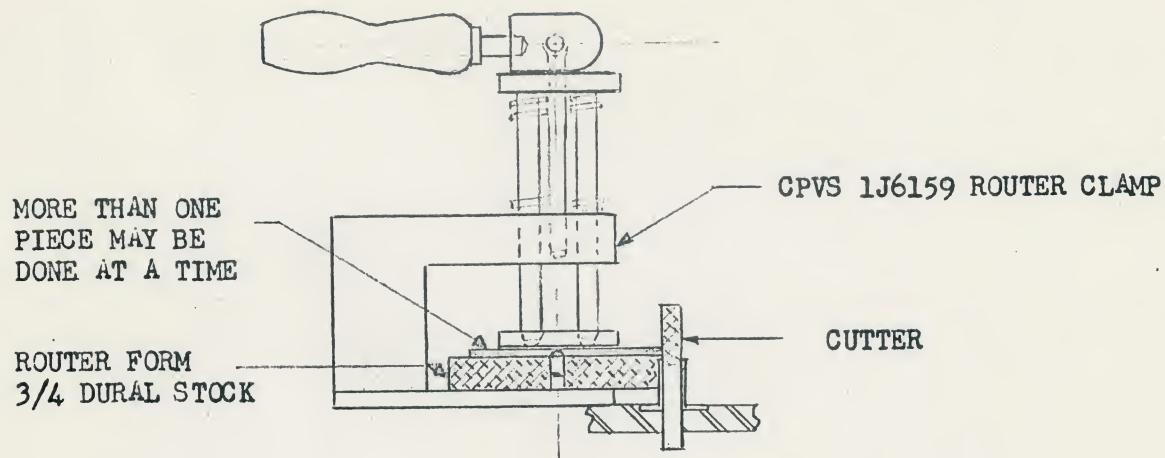
DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ROUTER FORM
USED FOR LONG NARROW PARTS

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NOTE: 1. THIS TOOL NOT TO BE USED ON PARTS LESS THAN 16 INCHES OR MORE THAN 100 INCHES IN PERMIETER.

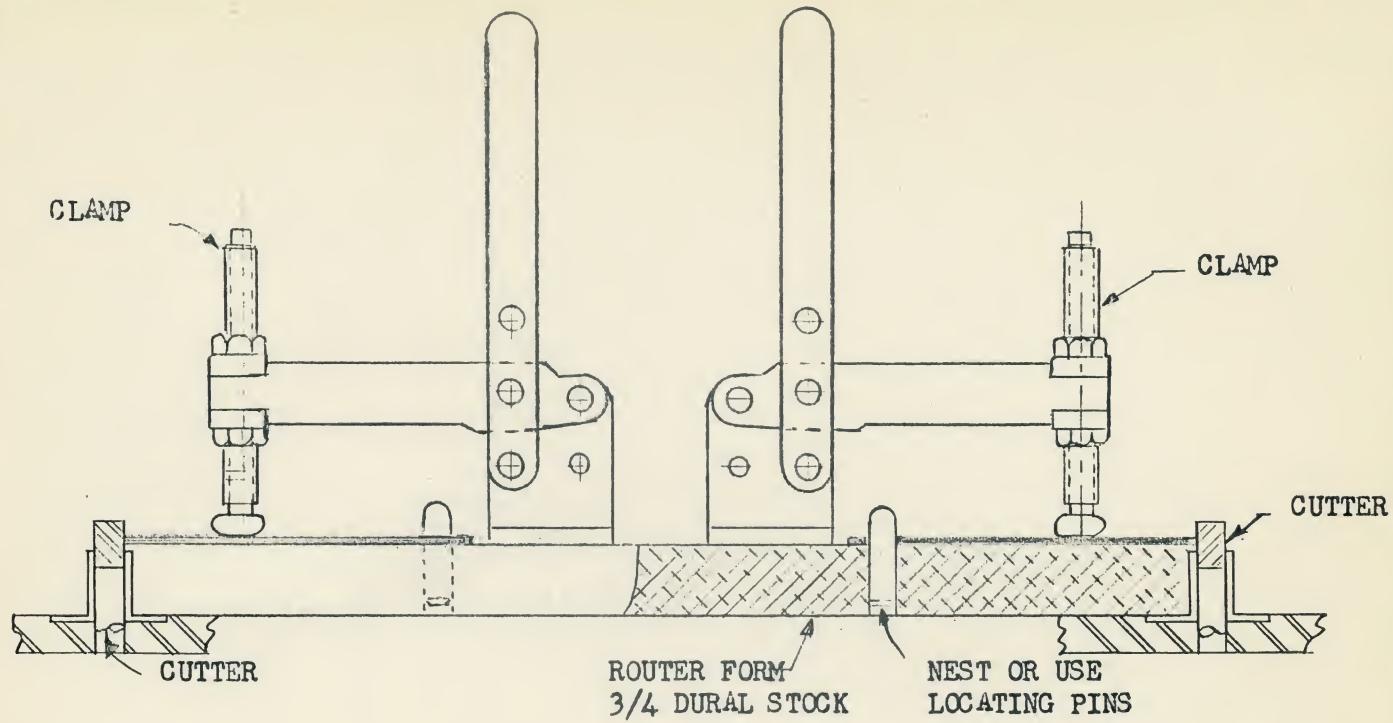
DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ROUTER FORM
USED ON SHAPER

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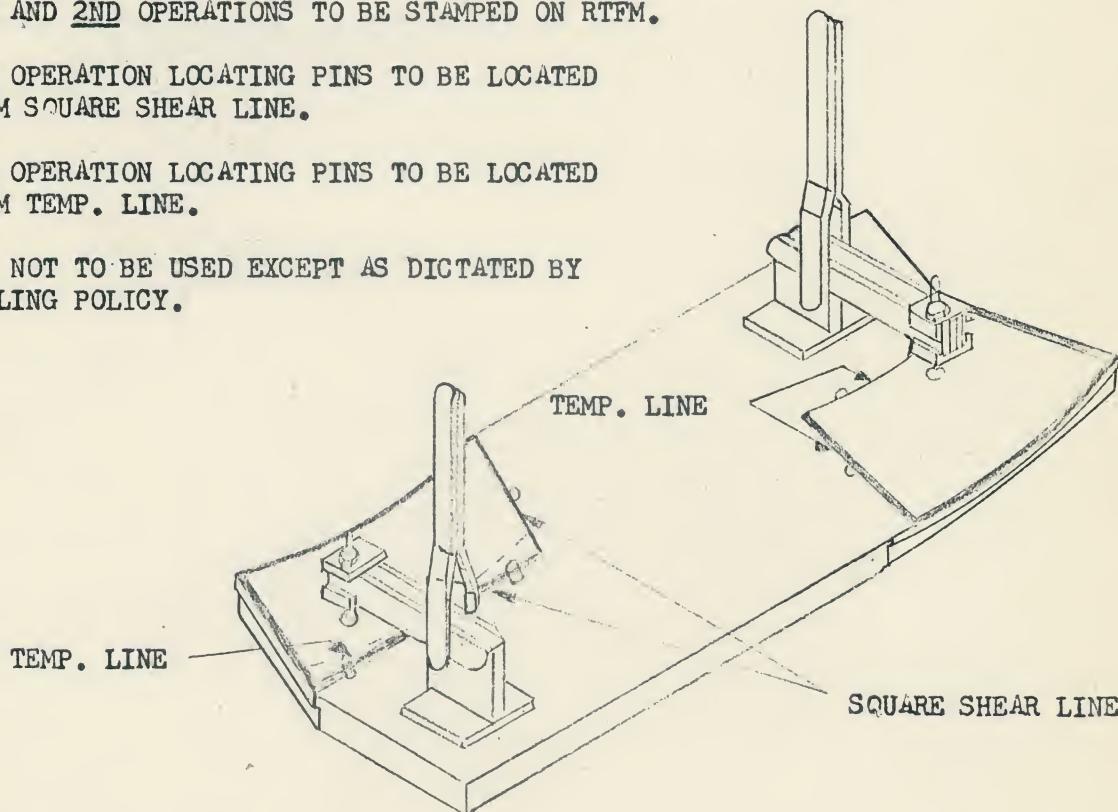
NOTE:

1ST AND 2ND OPERATIONS TO BE STAMPED ON RTFM.

1ST OPERATION LOCATING PINS TO BE LOCATED
FROM SQUARE SHEAR LINE.

2ND OPERATION LOCATING PINS TO BE LOCATED
FROM TEMP. LINE.

3 NOT TO BE USED EXCEPT AS DICTATED BY
TOOLING POLICY.



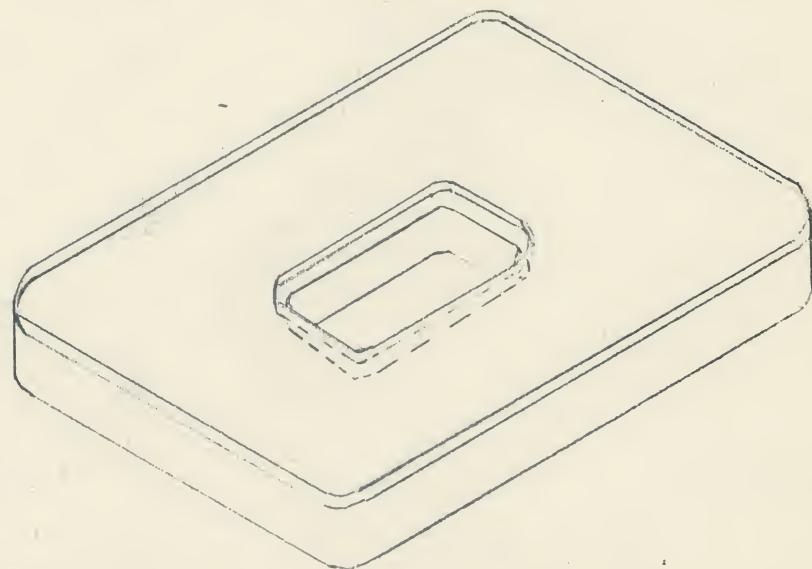
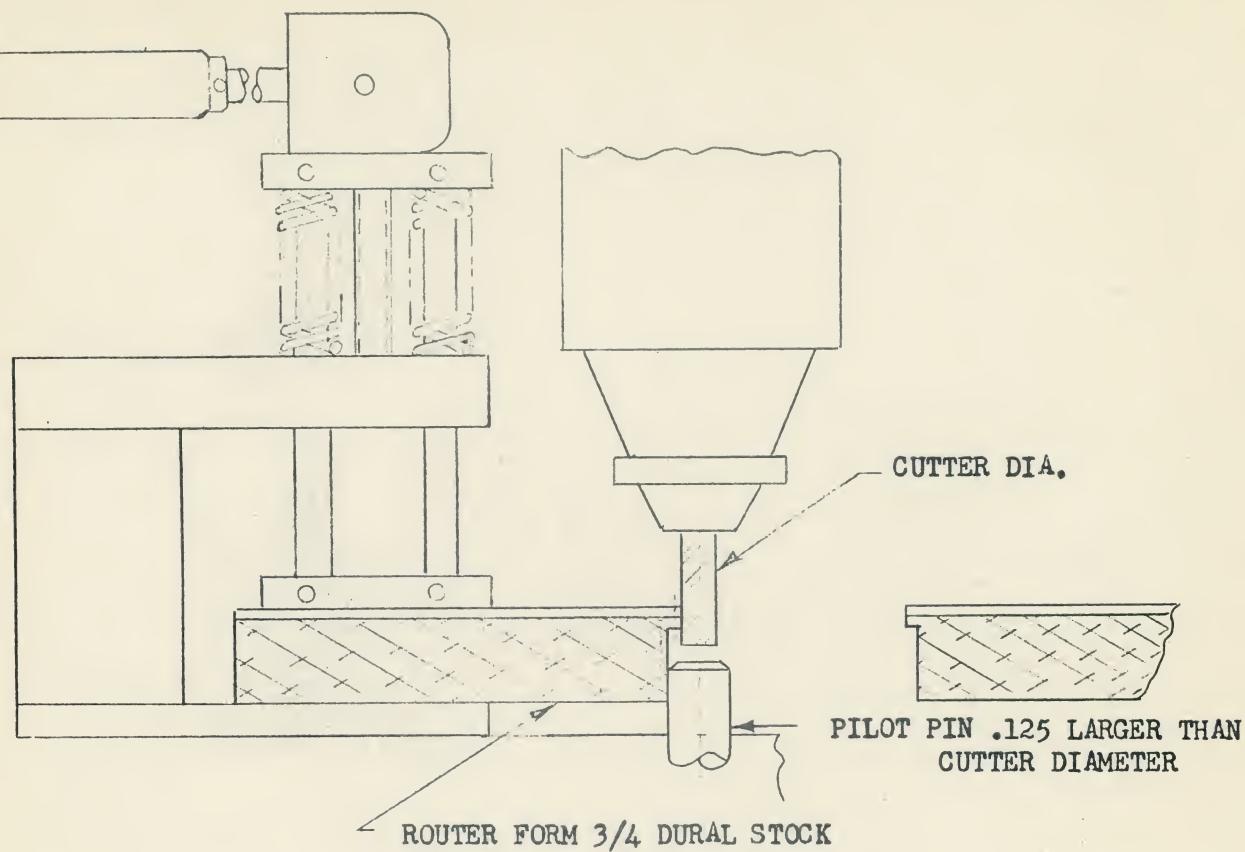
DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ROUTER FORM
USED FOR STOCK UNDER 3" X 5" DIM.

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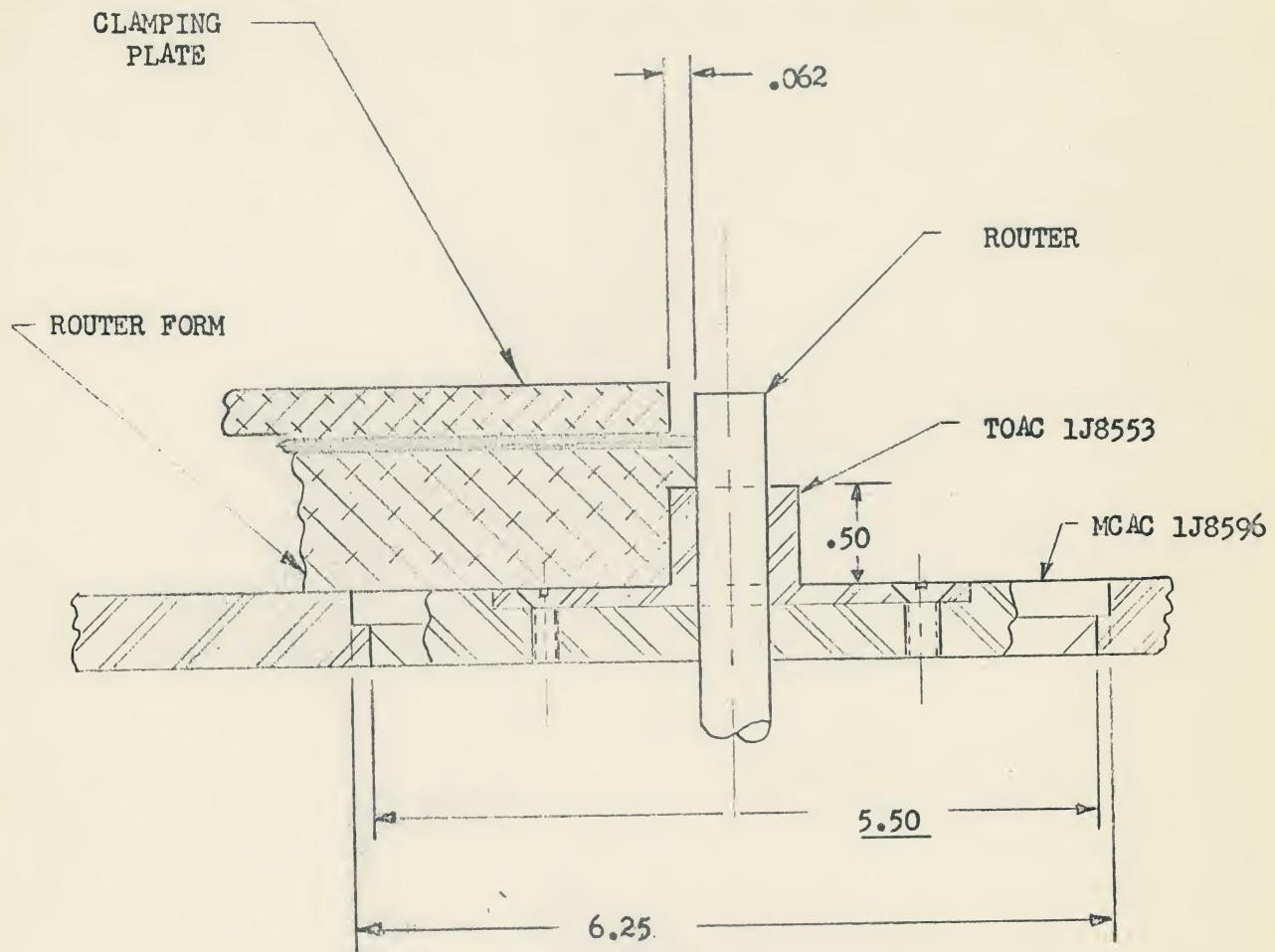


NOTE: USED ON ONSTRUD OVERHEAD ROUTER, THIS IS THE PREFERRED METHOD OF ROUTING INSIDE PERIMETERS.

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

OVERHEAD ROUTING
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NOTE: .062 STEP TO BE MAINTAINED ON ALL TABLE ROUTER FORMS.

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

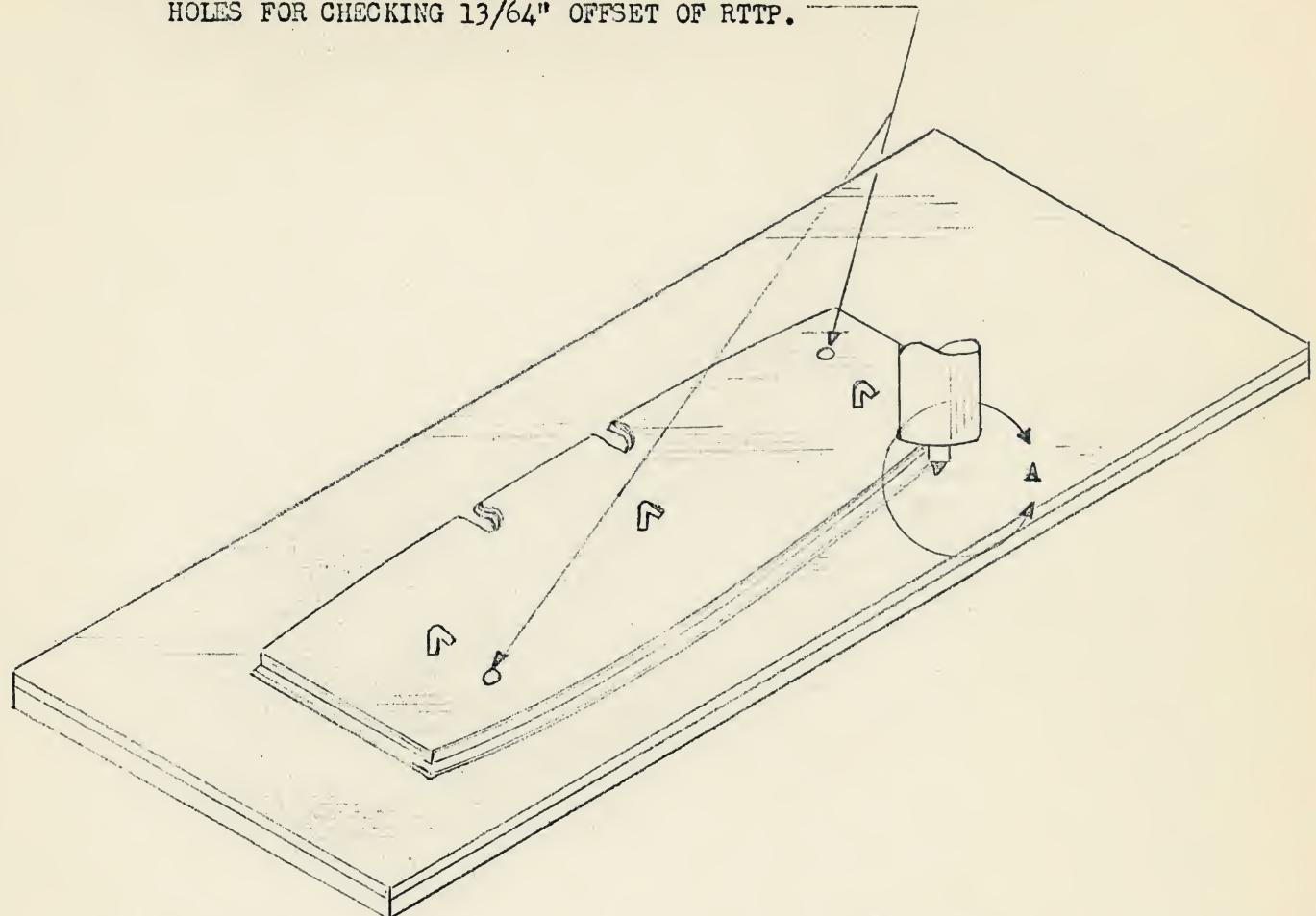
TYPICAL APPLICATIONS FOR ROUTERS

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FOR GREATER EASE IN INSPECTING RTTP. THE PROD TEMP.
AND RTTP SHOULD HAVE TWO 1/4" DIA. COORDINATED TOOLING
HOLES FOR CHECKING 13/64" OFFSET OF RTTP.



PULL TYPE LOCATING PINS
REF. TOOL PLANNING

STD. 1900 BUSHING

ROUTER TEMPLATE
1/4" 24ST AL. AL.

1/2" PLYWOOD

PLYWOOD
TABLE TOP

VIEW - A

$\frac{13}{64}$ *

NOTE:

THIS ROUTER CAN BE USED FOR
ROUTING INTERNAL PERIMETERS.

IT IS NOT USED ON STOCK LESS
THAN 4" WIDE & NOT LESS THAN 100"
TOTAL EXTERNAL PERIMETER.

* NOTE: NOMINAL DIM IS $7/32$,
BUT THIS DIM. IS USED TO ADD
 $1/64$ TO THE TOOL FOR WEAR
ALLOWANCE.

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

ROUTING LARGE SHEETS
RADIAL METHOD

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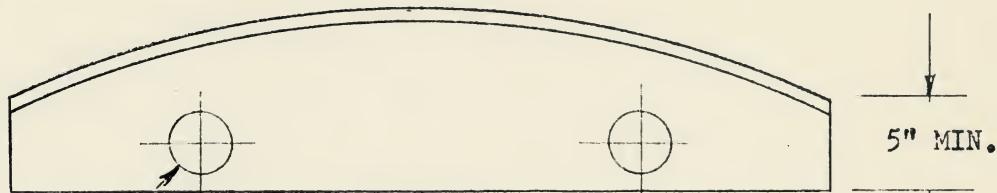


FIGURE 1

4.19 DIA. HOLES IN STFM'S TO BE USED ON A12 HUFFORD
3.19 DIA. HOLES IN STFM'S USED ON OTHER MACHINES

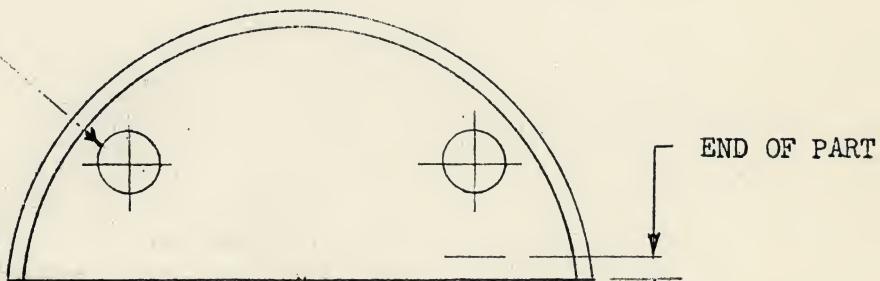


FIGURE 2

END OF STFM

THE DEPTH OF THE STFM IS DETERMINED BY A NUMBER OF FACTORS, SUCH AS THE LOCATION OF THE MOUNTING HOLES, THE RADIUS AND DEGREE OF BEND, ETC. A BASIC FORMULA TO FOLLOW IS TO MAINTAIN A 5" MIN. DEPTH AT THE END OF THE FORM FOR LARGE RADIUS AND SMALL ANGLES (FIG 1) FOR SMALLER RADII AND LARGE DEGREES OF BENDS (FIG 2). THE BASIC RULE OF CUTTING THE END OF THE FORM 1" FROM THE END OF THE PART MUST BE HELD. MOUNTING HOLES SHALL BE PLACED IN THE FORM BY CONVAIR.

DRILL AND TAP STFM FOR EYEBOLTS TO FACILITATE HANDLING. DETERMINE SIZE FOR WEIGHT AND SIZE OF STFM.

EYE BOLTS AVAILABLE ARE:	1/2-13 CVAC BOL 1705-5
	5/3-11 CVAC BOL
	3/4-10 CVAC BOL 1705-10

DRAWN	CANE 11-1-56	STFM DATE	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBING 11-1-56		
APPROVED			
APPROVED			
		CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	PAGE 146

MATERIAL FOR STRETCHER FORMS

PLYWOOD SHOULD BE USED FOR STFM'S WHEN ALL THE FOLLOWING CONDITIONS EXIST:

1. WHEN MAKING 12 PARTS OR LESS.
2. WHEN THICKNESS OF PART IS .090 OR LESS.
3. WHEN LENGTH OF PART IS 6 FEET OR LESS.
4. WHEN CHORD HEIGHT OF CONTOUR IS 6 INCHES OR LESS.

USE CAST DURAL AND/OR HI'DEN FOR ALL OTHER CONDITIONS.

DRAWN	CAME 10-29-56	MATERIAL FOR STRETCHER FORMS	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION PROCEDURES MANUAL
CHECKED	ROBBINS 11-1-56			
APPROVED				
APPROVED				PAGE 147

STRETCH FORM LAYOUT PROCEDURE

1. SYMMETRICAL STRETCH FORMS

LAYOUT PLAN VIEW OF SYMMETRICAL PART FORM WITH ITS CENTER LINE AND ADD NECESSARY TRIM TANGENT TO ENDS OF PART AT BOTH ENDS, AS SHOWN IN ILLUSTRATION ON FOLLOWING PAGE.

DRAW A LINE THROUGH THESE POINTS AND PERPENDICULAR TO THE CENTER LINE. CALL THIS THE "TRIM LINE".

ALL A MARGIN BEYOND "TRIM LINE" TO PROVIDE EXTRA MATERIAL IN THE EVENT THAT A CORRECTION IS NECESSARY DUE TO SPRINGBACK. THIS MARGIN SHOULD BE A MINIMUM OF 2.00 ON DEEP STRETCH FORMS AND INCREASED TO WIDTH NECESSARY FOR STRENGTH ON EXTREMELY SHALLOW DIES. THIS MARGIN LINE MUST BE PARALLEL TO "TRIM LINE" AND INTERSECT TANGENTS OF THE FORM CURVE. CALL THIS THE "FORM LINE".

AFTER THE STRETCH FORM HAS BEEN TRIED OUT AND CORRECTED FOR SPRINGBACK IF NECESSARY, THE STRETCH FORM ENDS ARE CUT BACK AT .50 BEYOND TRIM LINE. THIS CUT-BACK IS MADE PERPENDICULAR TO PULL-OFF TANGENT LINE TO CLEAR EXTRUSION JAWS AND THEREBY REDUCE EXTRA STOCK BEYOND ACTUAL PART LENGTH TO A MINIMUM. WHEN THIS PERPENDICULAR CUT DOES NOT INTERSECT THE FORM LINE WITHIN 6.00, THE CUT IS STOPPED AT 6.00 AND ANOTHER CUT IS MADE PERPENDICULAR TO FIRST CUT AND INTERSECTING THE "FORM LINE".

THE SHADED AREA IN FOLLOWING ILLUSTRATION IS AN EXAMPLE OF A COMPLETED SYMMETRICAL FORM DIE.

NOTE: REFER TO TOOL ENGINEERING EQUIPMENT & DESIGN DATA MANUAL FOR MACHINE CAPACITIES, MAXIMUM DIE SIZES AT DIFFERENT ARM POSITIONS. PAGES 7.16.01 TO 7.16.08

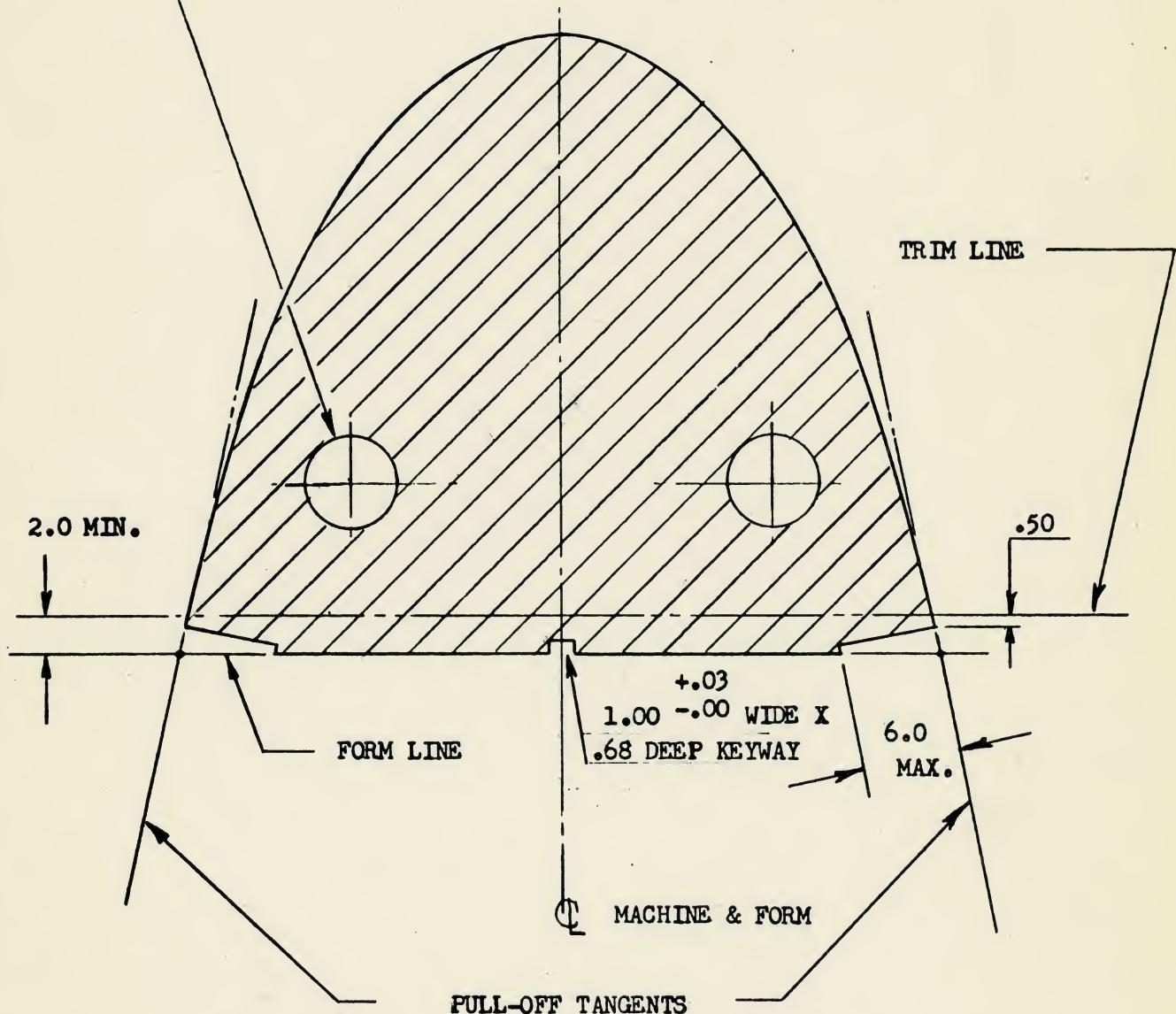
DRAWN	ROBBINS 4-10-56
CHECKED	
APPROVED	
APPROVED	CONNELL 4-10-56

LAYOUT PROCEDURE - SYM. STRETCH FORMS
SHERIDAN E 40-12

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* HOLES FOR HUFFORD MACHINE



* HOLES FOR HUFFORD MOUNTING TO BE PUT IN STFM'S FOR SHERIDAN SO STFM CAN BE USED ON EITHER MACHINE.

DRAWN	ROBBINS 4-10-56
CHECKED	
APPROVED	
APPROVED	CONNELL 4-10-56

SYMMETRICAL STRETCH FORMS
SHERIDAN E 40-12
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STRETCH FORM LAYOUT PROCEDURE

2. NON-SYMMETRICAL STRETCH FORMS:

THE NON-SYMMETRICAL STRETCH FORM CAPACITY OF THIS MACHINE FALLS WITHIN SAME SIZE LIMITS AS SHOWN FOR SYMMETRICAL DIES, BUT LAYOUT IS FURTHER DETERMINED BY THE RATIO OF THE TWO PULL-OFF ANGLES. THE LIMITATIONS IN SIZE OF PARTS INCREASES AS THE DIFFERENCE IN PULL OFF ANGLES BECOMES GREATER.

IT IS DESIRABLE TO HAVE AN ACCURATE LAYOUT OF THE ARCS OF TENSION CYLINDER TRUNNIONS TOGETHER WITH THE LINE OF DIE SUPPORT FACE AT MAXIMUM STROKE POSITION. THIS LAYOUT TO BE A CONVENIENT SCALE SIZE; REFER TO PREVIOUS PAGES FOR DIMENSIONS.

LAYOUT PLAN VIEW OF PART, FIGURE #1, USING SAME SCALE AS FOR ABOVE LAYOUT OF MACHINE.

CONSTRUCT PULL-OFF TANGENT LINES AT BOTH ENDS AND INCLUDE LENGTH OF TRIM ALLOWANCE ON THESE LINES. DRAW A LINE THROUGH THESE POINTS AND CALL THIS THE "TRIM LINE". ADD A MARGIN BEYOND THE "TRIM LINE" TO PROVIDE EXTRA MATERIAL IN THE EVENT CORRECTION FOR SPRINGBACK IS NECESSARY. THIS MARGIN SHOULD BE A MINIMUM OF 2.00 AND INCREASED AS NECESSARY FOR STRENGTH REQUIRED ON SHALLOW STRETCH FORMS. THIS LINE MUST BE PARALLEL TO "TRIM LINE" AND INTERSECT THE TANGENTS OF FORM CURVE AT BOTH ENDS. CALL THIS THE "FORM LINE" MARK THE INTERSECTION AT THE MINOR ANGLE "A" AND AT THE OPPOSITE END "B".

DRAW A TANGENT ACROSS THE FRONT FACE OF THE FORM CURVE PARALLEL TO "FORM LINE". CALL THIS THE "FACE LINE". NOTE WHERE THE "FACE LINE" INTERSECTS THE PULL-OFF TANGENT LINES. FIND THE POINT MIDWAY ALONG THE "FACE LINE" AND MARK THIS "C". DRAW A LINE THROUGH "C" AND PERPENDICULAR TO THE "FORM LINE".

DISTANCE "X" OR DISTANCE FROM LINE THROUGH "G" TO NEAREST END OF FORM, MUST BE AT LEAST A MINIMUM DIMENSION FOR EACH DIFFERENT ARM POSITION AS LISTED BELOW. IF IT IS NOT, THEN RELOCATE LINE TO MINIMUM DIMENSION AND PARALLEL TO LINE THROUGH "C". THIS LINE EITHER THROUGH POINT "C", OR AS RELOCATED, NOW REFERENCES CENTER LINE OF MACHINE.

<u>ARM POSITION</u>	<u>"X" MINIMUM DIMENSION</u>
#1	10.50
#2	42.00
#3	71.00

EXTEND PULL-OFF TANGENT LINES BELOW INTERSECTION WITH "TRIM LINE" FOR A DISTANCE OF 21.00 PLUS 5% OF TOTAL LENGTH OF PART BEING FORMED. THIS REPRESENTS DISTANCE FROM CENTER LINE OF TENSION CYLINDER TRUNNIONS TO FACE OF JAW. LEAVING ENOUGH STROKE IN CYLINDER FOR FINAL STRETCHING OF PART. THIS DISTANCE "Y" IS SAME AT BOTH ENDS.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-5-56
APPROVED	
APPROVED	

LAYOUT PROCEDURE
NON-SYMMETRICAL FORMS - SHERIDAN
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STRETCH FORM LAYOUT PROCEDURE - CONT.

BEYOND LENGTH "Y" AND ALONG SAME TANGENT LINES, MARK OFF A DISTANCE OF 30.00 MINUS THE 5% OF TOTAL PART LENGTH, WHICH REPRESENTS THE REMAINING TENSION CYLINDER STROKE. CALL THESE LENGTHS "Z".

SUPERIMPOSE FORM LAYOUT ON LAYOUT OF TENSION CYLINDER ARCS, WITH CENTER LINE COINCIDENT. MOVE "FORM LINE" OF STRETCH FORM LAYOUT BETWEEN THE AREA CREATED BY THE LINE OF MAXIMUM DIE TABLE STROKE AND A PARALLEL LINE THROUGH THE OUT-BOARD POINTS OF TENSION CYLINDER ARCS. IF LENGTHS "Z" EITHER INTERSECT OR BECOME TANGENT TO THE TENSION CYLINDER TRUNNION ARCS SIMULTANEOUSLY AT ANY POINT ALONG THIS LINE, THE STRETCH FORM IS READILY ADAPTABLE TO MACHINE.

HOWEVER, IF ONE LEG OR OTHER ALONG LENGTH "Z" OF STRETCH FORM FAILS TO JOIN OR INTERSECT THE ARCS OF TRUNNIONS, ROTATE STRETCHER FORM ABOUT POINT "C", UNTIL BOTH LEGS "Z" INTERSECT THE ARCS. ANY INCREASE IN ROTATION WILL INCREASE SIZE OF STRETCH FORM BUT CARE MUST BE TAKEN IN USING THE EXTREMES OF EITHER ENDS OF "Z", REPRESENTING THE STROKE REMAINING IN TENSION CYLINDERS.

FIGURE 2 SHOWS A DIE FORM ROTATED ABOUT POINT "C" UNTIL BOTH ITS LENGTHS "Z" SIMULTANEOUSLY INTERSECT TRUNNION ARCS.

RELOCATE "FORM LINE" PERPENDICULAR TO $\frac{1}{2}$ OF THE MACHINE, FROM POINT "A" TO "D". DRAW FACE LINE TANGENT TO STRETCH FORM AND PARALLEL TO NEW "FORM LINE". LOCATE POINT "E" ON FACE LINE AND MIDPOINT OF INTERSECTION WITH PULL-OFF TANGENTS. DRAW A LINE THROUGH POINT "E" AND PERPENDICULAR TO FORM LINE. THIS LINE REFERENCES CENTER LINE OF MACHINE AND NEW STRETCH FORM.

ALIGN CENTER LINE OF NEW STRETCH FORM WITH CENTER LINE OF LAYOUT OF MACHINE AS BEFORE. CHECK TO SEE THAT BOTH LENGTHS "Z" INTERSECT TRUNNION ARCS WITHIN DIE TABLE STROKE AREA AS BEFORE. DUE TO SHIFTING THE CENTER LINE, ONE OF THE LENGTHS "Z" MAY AGAIN BE SHORT OF INTERSECTING TRUNNION ARC. REPEAT PROCESS IF NECESSARY UNTIL CORRECTED STRETCH FORM IS ACHIEVED.

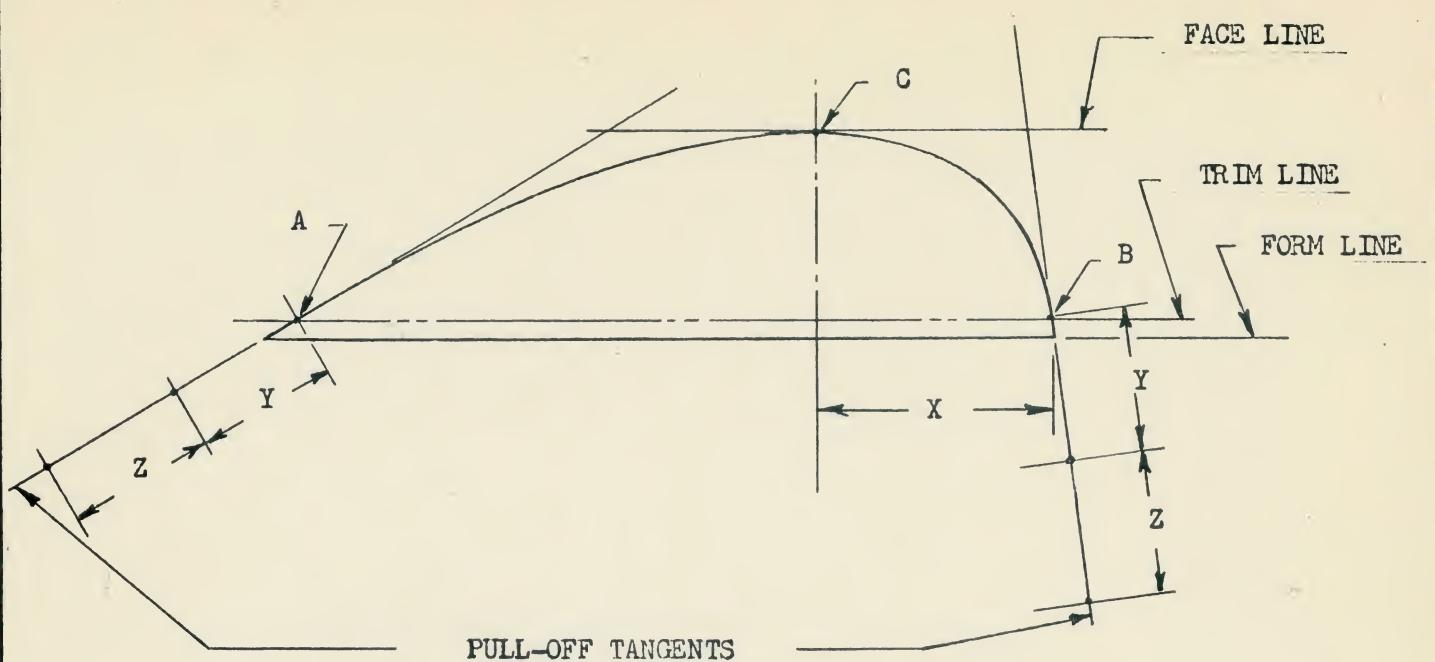
AFTER STRETCH FORM HAS BEEN TRIED OUT AND CORRECTED FOR SPRING BACK IF NECESSARY, THE DIE ENDS ARE CUT BACK .50 BEYOND THE TRIM LINE. THIS CUT OFF IS MADE PERPENDICULAR TO PULL-OFF TANGENT AND NOT TO EXCEED 6.00. IF CUT DOES NOT INTERSECT "FORM LINE" WITHIN 6.00 IT IS TERMINATED AT 6.00 AND ANOTHER CUT PERPENDICULAR TO IT AND INTERSECTING "FORM LINE" IS MADE.

SHADED AREA SHOWN IN FIGURE #2 SHOWS COMPLETED NON-SYMMETRICAL STRETCH FORM EXCEPT KEY WAY WHICH IS TO BE 1.00 $^{+.03}_{-.00}$ WIDE X .68 DEEP TO FALL ON $\frac{1}{2}$ OF MACHINE. ALSO HOLES SHOULD BE ADDED FOR USING ON HUFFORD MACHINE SO THAT STRETCH FORM MAY BE USED ON EITHER MACHINE.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-5
APPROVED	
APPROVED	

LAYOUT PROCEDURE
NON-SYMMETRICAL - SHERIDAN
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$Y = 21.00 + 5\% \text{ OF PART LENGTH}$

$Z = 30.00 - 5\% \text{ OF PART LENGTH}$

FIGURE # 1

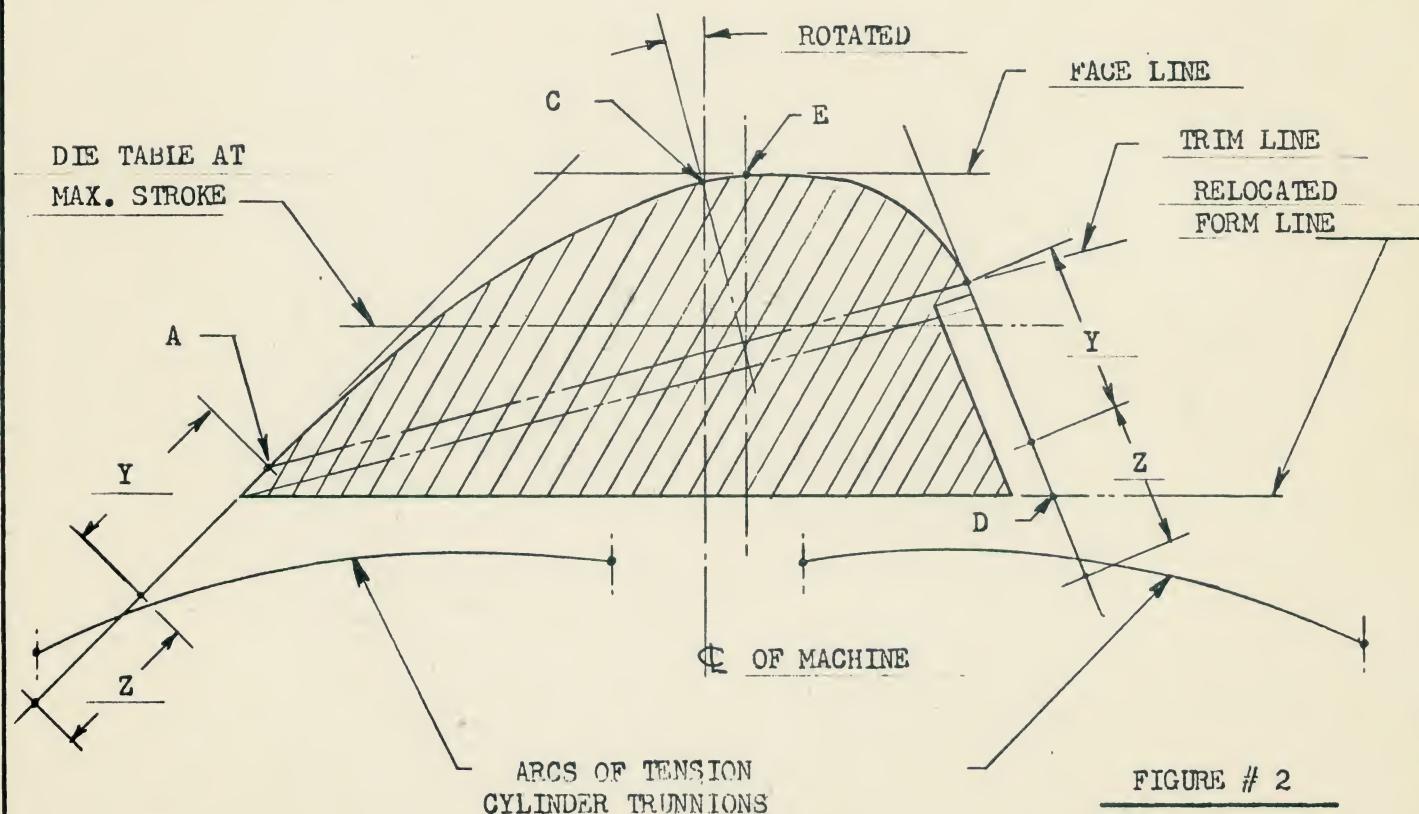


FIGURE # 2

DRAWN	ROBBINS 4-10-56
CHECKED	
APPROVED	
APPROVED	CONNELL 4-10-56

NON - SYMMETRICAL STRETCH FORMS
SHERIDAN E 40-12

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POSITIVE POSITION FORMING TEMPLATE

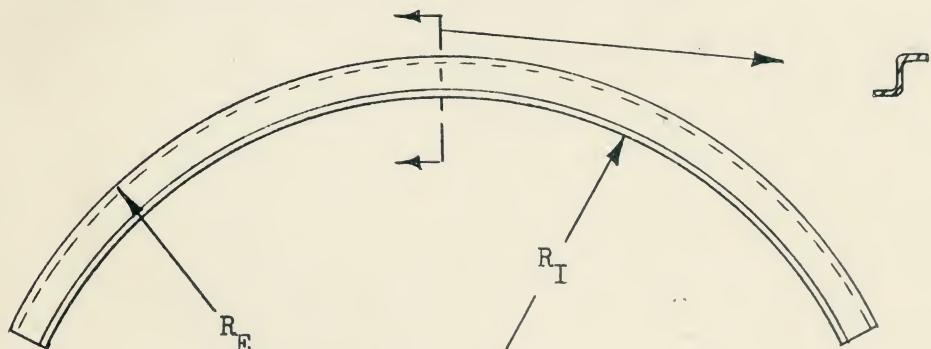
POSITIVE POSITION FORMING TEMPLATES ARE TO BE MADE OF 1/2 INCH PLYWOOD FOR SMALLER SIZES AND 3/4 INCH FOR LARGER SIZES. A SMALL NAIL IS PUT INTO FACE OF TEMPLATE AT CENTER LINE OF MACHINE FOR HOLDING RINGS ON ENDS OF SENSING TAPES, WHICH UNREEL FROM UNITS ATTACHED ABOVE EACH EXTRUSION JAW. CENTER LINE SHOULD BE SCRIBED ON TEMPLATE CORRESPONDING TO CENTER LINE OF STRETCH FORM FOR REFERENCE PURPOSES IN SETTING UP MACHINE.

THE SHAPE OF THE TEMPLATE IS DETERMINED FROM SHAPE OF STRETCH FORM AS SHOWN.

IT IS DESIRABLE TO HAVE RADIUS OF TEMPLATE SLIGHTLY LESS THAN STRETCH FORM RADIUS AT INNERMOST FIBRE OF PART. THIS MOVES NEUTRAL AXIS OF BEND INWARD TO WHERE IT IS NOT IN ACTUAL PART AND ELONGATES ALL SECTIONS OF PART PREVENTING COMPRESSION WRINKLES. IF POSSIBLE THERE SHOULD BE ABOUT 1% ELONGATION OF INNERMOST FIBRES OF PART.

FIRST CHECK AMOUNT OF ELONGATION OF EXTREME FIBRES OF SECTION AS FOLLOWS:

CONSTANT RADIUS FORM (RADIUS KNOWN):



$$E = \frac{(R_E - R_I) \times 100}{R_I}$$

WHEN

E = PERCENTAGE OF ELONGATION

R_E = RADIUS OF EXTREME FIBRES

R_I = RADIUS OF INNERMOST FIBRES

EXAMPLE: ASSUME INSIDE RADIUS OF PART CURVE IS 29.00 & SECTION IS 1.00 WIDE.

$$E = \frac{(30-29) \times 100}{29} \quad E = \frac{100}{29} = 3.4\% \text{ ELONGATION REQUIRED TO STRETCH FORM}$$

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-5-56
APPROVED	
APPROVED	

CTTP (CONTROL TEMPLATE)
SHERIDAN E 40-12

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

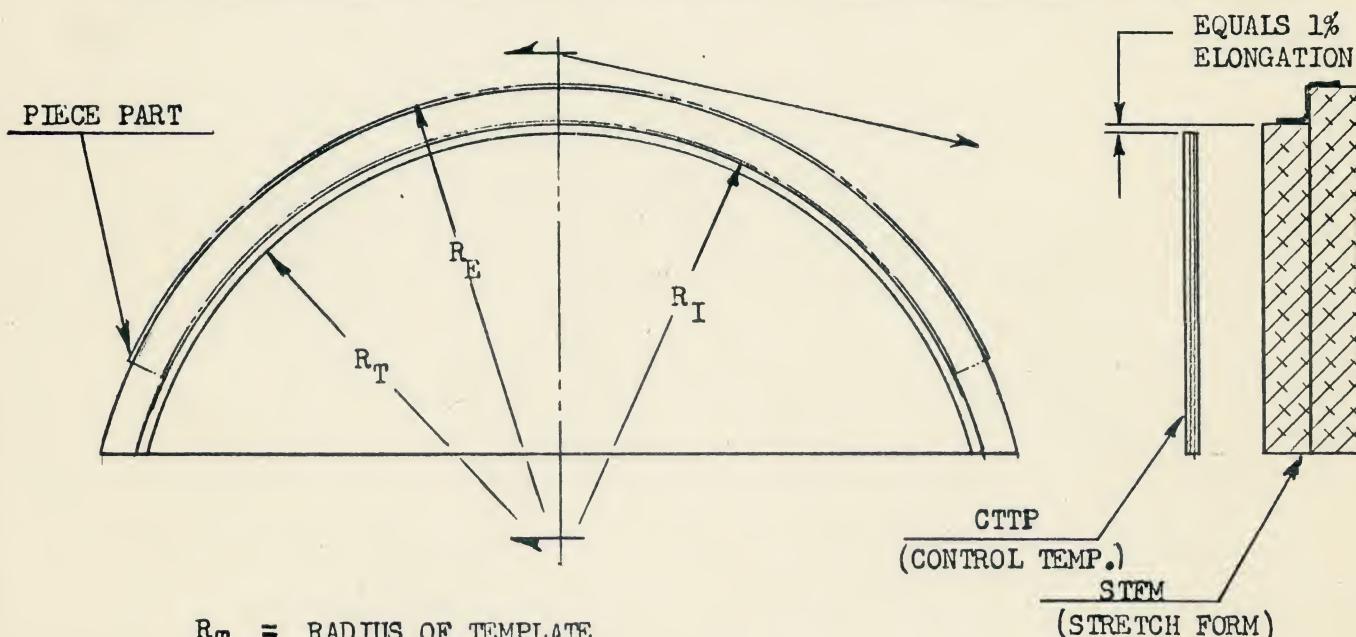
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IF THIS PERCENTAGE OF ELONGATION IS WITHIN PERMISSABLE ELONGATION OF MATERIAL THEN PART CAN BE SUCCESSFULLY STRETCH FORMED. IF IT EXCEEDS MAXIMUM ELONGATION THEN PART CANNOT BE STRETCH FORMED.

WHEN THE AMOUNT OF ELONGATION REQUIRED TO FORM, AS DETERMINED BY FORMULA GIVEN, IS MORE THAN 1% BELOW MAXIMUM PERMISSABLE ELONGATION, TAKE THE DIFFERENCE BETWEEN R_E AND R_I (OR SECTION WIDTH IN PLANE OF FORM) AND DIVIDE IT BY PERCENTAGE OF ELONGATION REQUIRED TO FORM. SUBTRACT THIS AMOUNT FROM R_I (INNERMOST RADIUS) AND RESULT IS DIMENSION FOR RADIUS OF TEMPLATE. THE DIFFERENCE IN DIMENSIONS OF PART RADIUS AND TEMPLATE RADIUS THUS OBTAINED WILL THEN BE USED AS A CONSTANT DIMENSION BETWEEN FORM AND TEMPLATE FOR FULL LENGTH.

IF ELONGATION IS REQUIRED TO FORM IS 1% OR LESS BELOW MAXIMUM PERMISSABLE, THEN A COMPROMISE MUST BE MADE ON TEMPLATE TO KEEP ELONGATION WITHIN LIMITS.



$R_T = \text{RADIUS OF TEMPLATE}$

$$R_T = R_I - \left(\frac{R_E - R_I}{E} \right)$$

USING SAME PART FOR EXAMPLE AS ON PREVIOUS PAGE

$$R_T = 29 - \left(\frac{30.00 - 29.00}{3.4} \right) \quad R_T = 29 - \frac{1.00}{3.4} \quad R_T = 28.706$$

DRAWN	ROBBINS 4-10-56	CTTP (CONTROL TEMPLATE) POSITIVE POSITION FORMING - SHERIDAN	CONVAIR A DIVISION OF GENERAL DYNAMICS CORPORATION SAN DIEGO	TOOL FABRICATION PROCEDURES MANUAL
CHECKED				
APPROVED				
APPROVED	CONNELL 4-10-56			PAGE 154

POSITIVE POSITION FORMING TEMPLATE

NON CONSTANT (OR CONSTANT) FORM CURVES WHEN RADIUS IS NOT KNOWN:

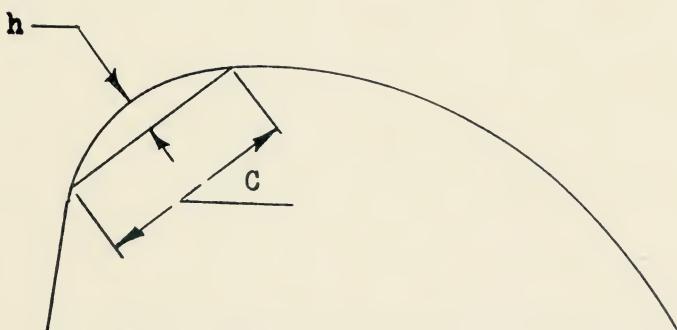
- a) DETERMINE RADIUS OR APPROXIMATE RADIUS, AS OUTLINED BELOW, OF SECTION WITH SHARPEST BEND.
- b) USING THIS RADIUS CALCULATE ELONGATION AND TEMPLATE RADIUS SAME AS OUTLINED FOR CONSTANT SECTIONS. SAME RELATION BETWEEN FORM AND TEMPLATE IS USED FOR FULL LENGTH.

TO DETERMINE RADIUS OF CURVE MEASURE OFF A CHORD ON SECTION HAVING SMALLEST RADIUS, OR CURVATURE APPROACHING TRUE RADIUS. THIS CHORD MAY BE OF ANY CONVENIENT LENGTH BUT THE LONGER THE BETTER AS LONG AS ARC IT SUBTENDS IS OF NEARLY CONSTANT RADIUS. MEASURE HEIGHT FROM THIS CHORD LINE TO MAXIMUM POINT ON ARC.

DETERMINE RADIUS USING THIS FORMULA:

$$r = \frac{c^2 - 4h^2}{8h}$$

r = RADIUS OF PART
c = LENGTH OF CHORD
h = HEIGHT FROM CHORD TO
MAX. POINT ON ARC.



EXAMPLE: A CHORD 6.00 LONG IS LAID OUT ACROSS A CURVE AND DISTANCE FROM CHORD LINE TO MAXIMUM POINT ON ARC MEASURES .50.

$$r = \frac{6.00^2 + 4 \times .50^2}{8 \times .50} \quad r = \frac{36 + 1}{4} = 9.25$$

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

CTTP (CONTROL TEMPLATE)
POSITIVE POSITION FORMING

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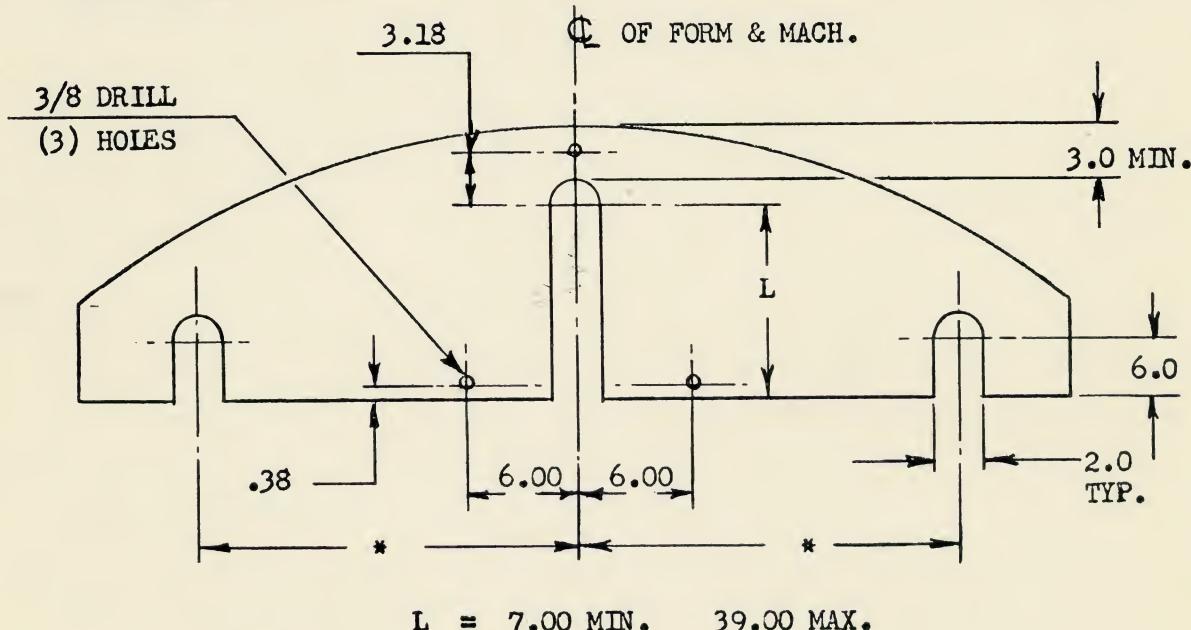
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POSITIVE POSITION FORMING TEMPLATES

THERE ARE THREE ANGLE BRACKETS ON MACHINE FOR ATTACHING TEMPLATE. ONE IS MOUNTED ON EACH SIDE OF HOLD DOWN CYLINDER OVERARM SUPPORT FRAME. THE CENTER LINE OF 3/8 HOLES IN THESE ARE 6.00 EACH SIDE OF $\frac{C}{2}$ OF MACHINE AND .38 FORWARD OF DIE SUPPORT FACE. THESE ARE AT A FIXED POSITION FOR ALL TEMPLATES. THE OTHER BRACKET IS ATTACHED TO FRONT OF OVERARM THAT CARRIES DIE HOLD DOWN CYLINDER. THIS OVERARM IS ADJUSTABLE FORWARD AND AFT AND THEREFORE BRACKET MOVES ACCORDINGLY ALONG $\frac{C}{2}$ OF MACHINE DEPENDING ON DIE HOLD DOWN POSITION REQUIRED FOR PARTICULAR DIE. HOLE IN TEMPLATE TO BE 3.18 FROM $\frac{C}{2}$ OF HOLD DOWN CYLINDER.

TEMPLATES ARE TO HAVE 2.0 WIDE SLOTS TO CLEAR HOLD DOWN CYLINDER RODS. ONE SLOT TO BE ON $\frac{C}{2}$ OF MACHINE AND FALL WITHIN 7.0 TO 39.0 RANGE OF ADJUSTMENT OF HOLD DOWN CYLINDER. A MINIMUM EDGE DISTANCE OF 3.0 IS DESIRABLE BUT MAY HAVE TO BE LESS ON EXTREMELY NARROW DIES.

OUTBOARD SLOT LOCATIONS TO BE DETERMINED ON MACHINE AT TIME OF SET UP. $\frac{C}{2}$ OF SLOT RADIUS TO BE 6.0 FROM BACK FACE IN FORE AND AFT DIRECTION AND TO BE DETERMINED BY DESIRED DIE HOLD DOWN LOCATIONS IN LATERAL DIRECTION.



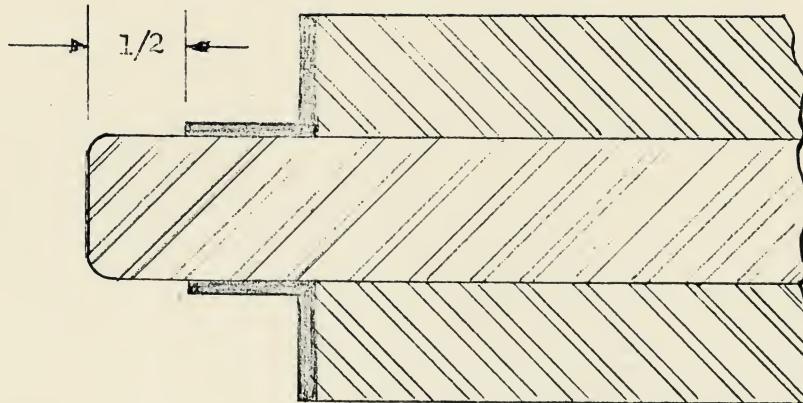
* DETERMINE AT TIME MACHINE IS SET UP FOR JOB.

NOTE: ENDS OF SLOTS MAY BE CUT OUT SQUARE INSTEAD OF HALF ROUND IF IT FACILITATES FABRICATION OF TEMPLATE.

DRAWN	ROBBINS	4-10-56
CHECKED		
APPROVED		
APPROVED	CONNELL	4-10-56

CTTP (CONTROL TEMPLATE)
POSITIVE POSITION FORMING
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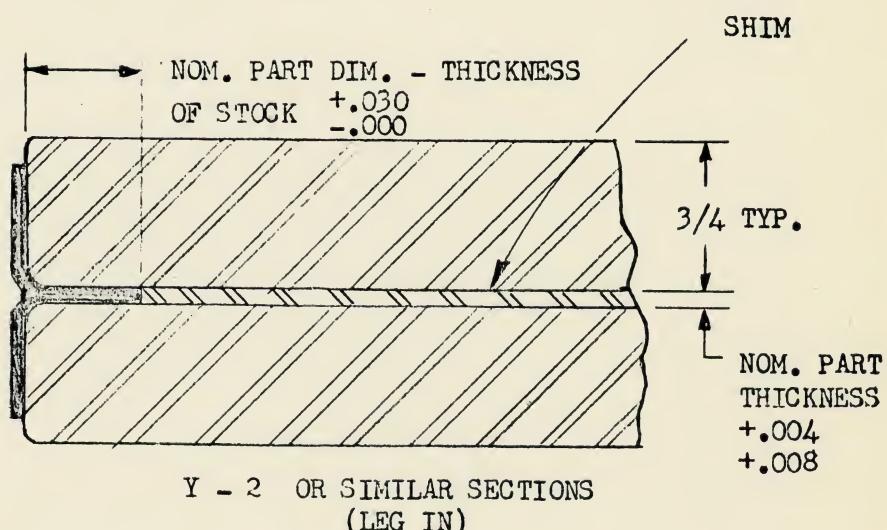
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Y - 2 OR SIMILAR SECTIONS
(LEG OUT)

ON HI'DEN STFM'S ADD A 6 X 6 C.R.S. PLATE WITH TAPPED HOLE FOR EYEBOLT. THE THICKNESS OF PLATE AND TAPPED HOLE SIZE SUITABLE FOR WEIGHT AND SIZE OF STFM. EYEBOLT SIZES AVAILABLE ARE 1/2-13, 5/8-11 AND 3/4-10. BOLT PLATE TO FORM (NO LAG SCREWS)

MATERIAL - DURAL PREFERRED
HI'DEN ACCEPTABLE SUB.



Y - 2 OR SIMILAR SECTIONS
(LEG IN)

NOTE: THE PERIMETER OF STRETCHER FORM MUST BE GREATER THAN THE PART LENGTH BY 1" ON EACH END.

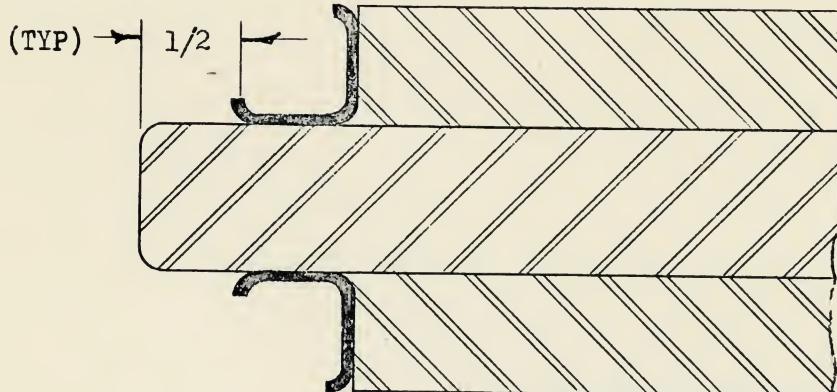
MATERIAL - DURAL

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TYPICAL CONSTRUCTION
HUFFORD STRETCHER FORMS
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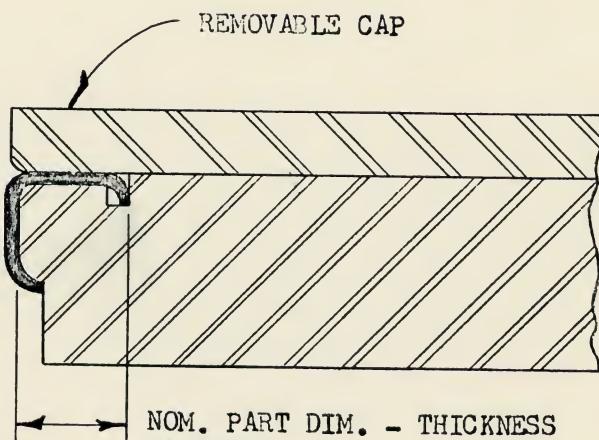
ON HI'DEN STFM'S ADD A 6 X 6 C.R.S. PLATE WITH TAPPED HOLE FOR EYEBOLT. THE THICKNESS OF PLATE AND TAPPED HOLE SIZE SUITABLE FOR WEIGHT AND SIZE OF STFM. EYEBOLT SIZES AVAILABLE ARE 1/2-13, 5/8-11 AND 3/4-10. BOLT PLATE TO FORM (NO LAG SCREWS).



NOTE: FOR L. H. PART ONLY,
BOTTOM MEMBER IS
REMOVED.

Y - 3 OR SIMILAR SECTIONS
(LEG OUT)

MATERIAL - DURAL PREFERRED
HI'DEN ACCEPTABLE SUBSTITUTE.



NOTE: SECTION MUST BE
PRE-ROLLED.

Y - 3 OR SIMILAR SECTIONS
(LEG IN)

ON HI'DEN STFM'S. ADD A 6 X 6 C.R.S. PLATE WITH TAPPED HOLE FOR EYEBOLT. THE THICKNESS OF PLATE AND TAPPED HOLE SIZE SUITABLE FOR WEIGHT AND SIZE OF STFM. EYEBOLT SIZES AVAILABLE ARE 1/2-13, 5/8-11 AND 3/4-10. BOLT PLATE TO FORM (NO LAG SCREWS).

MATERIAL - DURAL PREFERRED
HI'DEN ACCEPTABLE SUBSTITUTE

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

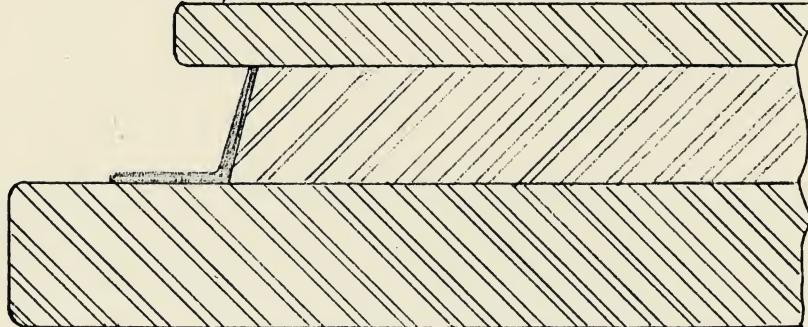
TYPICAL CONSTRUCTION
HUFFORD STRETCHER FORMS

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ADD CAP FOR ANY SECTION
WITH OPEN ANGLE.

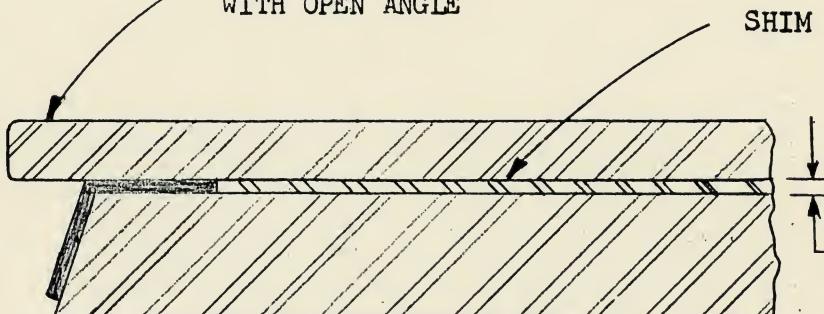


Y - 8 OR SIMILAR SECTIONS
(LEG OUT)

ON HI'DEN STFM'S ADD A 6 X 6 C.R.S. PLATE
WITH TAPPED HOLE FOR EYEBOLT. THE THICKNESS
OF PLATE AND TAPPED HOLE SIZE SUITABLE FOR
WEIGHT AND SIZE OF STFM. EYEBOLT SIZES
AVAILABLE ARE 1/2-13, 5/8-11 AND 3/4-10.
BOLT PLATE TO FORM (NO LAG SCREWS).

MATERIAL - DURAL PREFERRED
HI'DEN ACCEPTABLE SUBSTITUTE

ADD CAP FOR ANY SECTION
WITH OPEN ANGLE



Y - 8 OR SIMILAR SECTIONS
(LEG IN)

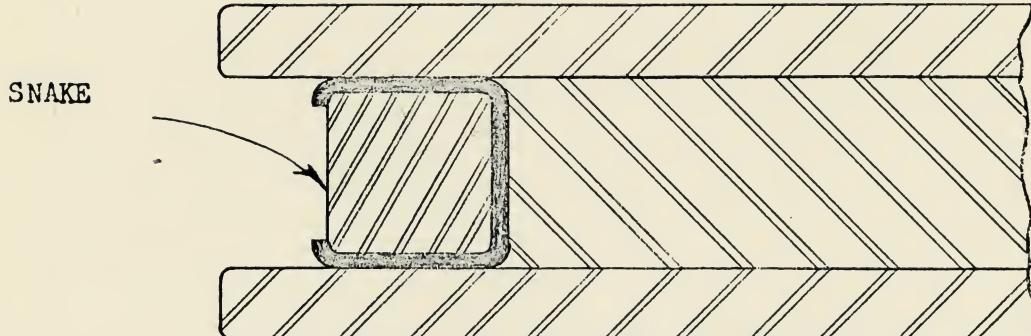
MATERIAL - DURAL

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TYPICAL CONSTRUCTION
HUFFORD STRETCHER FORMS
CONVAIR
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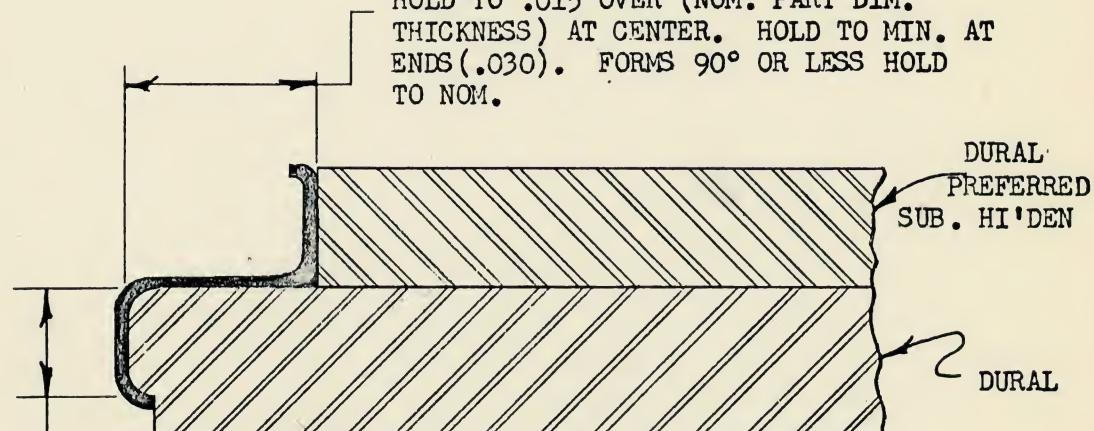


Y - 12 OR SIMILAR SECTIONS
(LEG OUT)

ON HI'DEN STFM'S ADD A 6 X 6 C.R.S.
PLATE WITH TAPPED HOLE FOR EYEBOLT.
THE THICKNESS OF PLATE AND TAPPED HOLE
SIZE SUITABLE FOR WEIGHT AND SIZE OF
STFM. EYEBOLT SIZES AVAILABLE ARE
1/2-13, 5/8-11 AND 3/4-10. BOLT
PLATE TO FORM (NO LAG SCREWS).

MATERIAL - DURAL PREFERRED
HI'DEN ACCEPTABLE SUBSTITUTE

FOR SECTIONS FORMED ON HALF CIRCLE,
HOLD TO .015 OVER (NOM. PART DIM.
THICKNESS) AT CENTER. HOLD TO MIN. AT
ENDS (.030). FORMS 90° OR LESS HOLD
TO NOM.



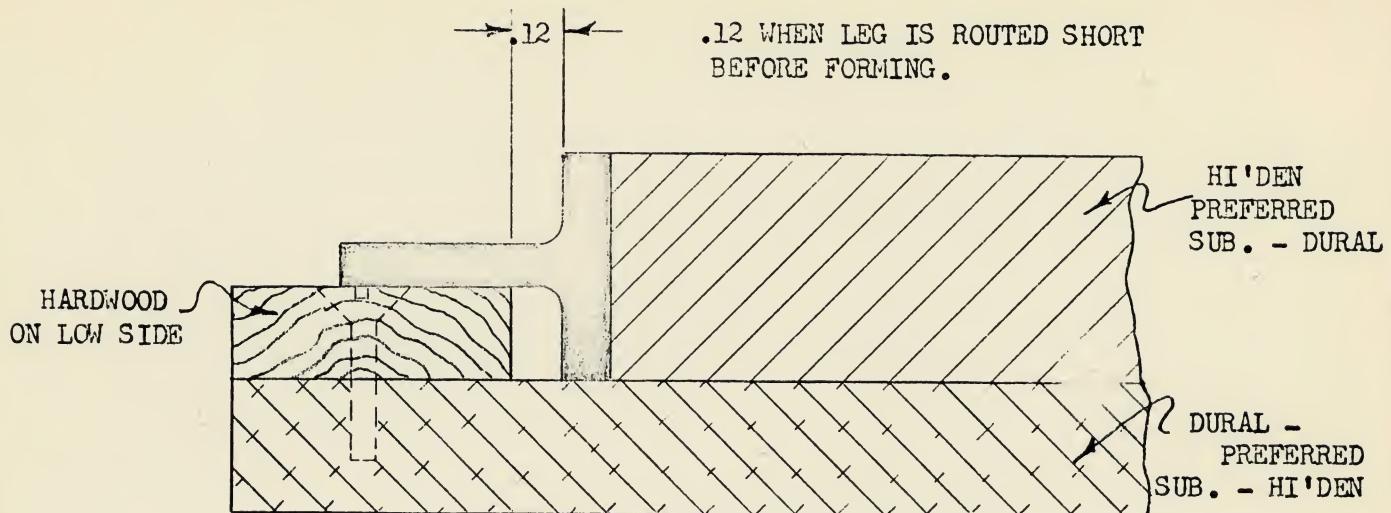
Y - 36 OR SIMILAR SECTIONS

1/32 UNDER NOM.
PART DIM. -2 STOCK
THICKNESS.

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-8-56
APPROVED	
APPROVED	

TYPICAL CONSTRUCTION
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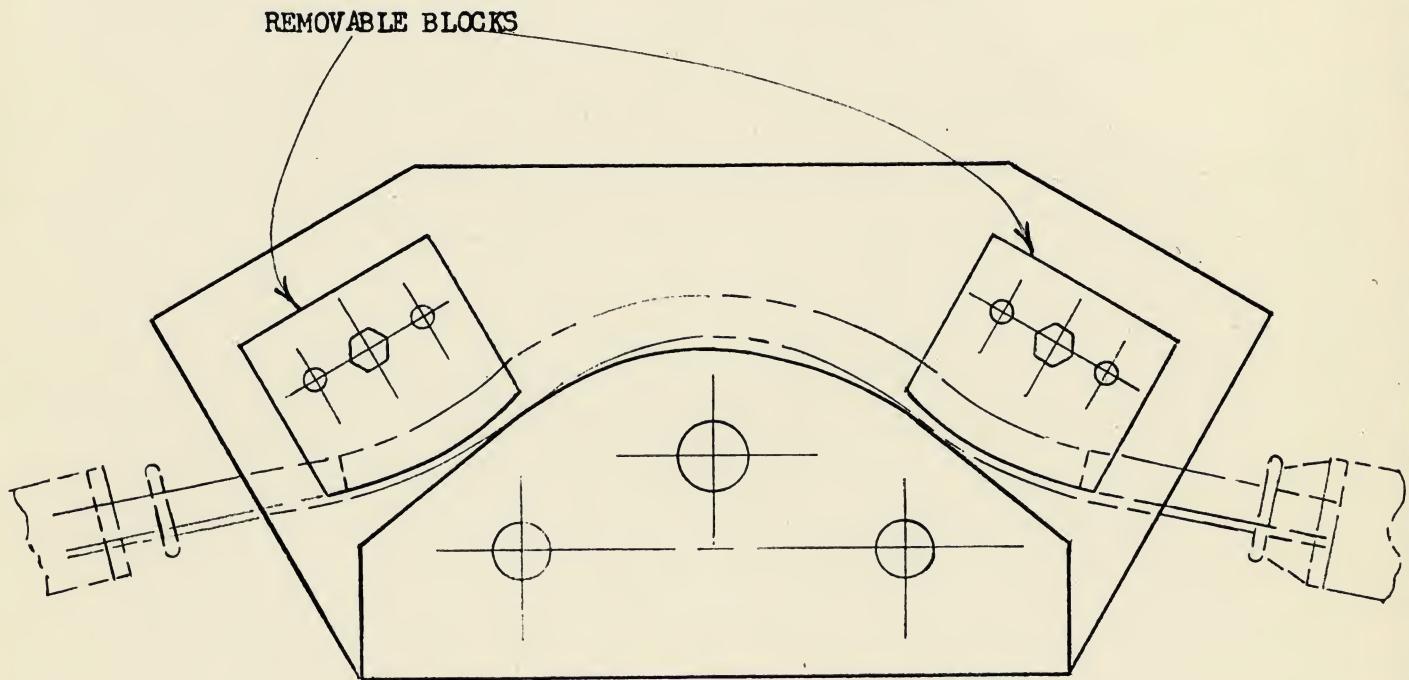
TEE SECTIONS PULLED WITH A LEG OUT MUST HAVE A SUPPORT TO KEEP LEG IN PLANE OF STATION.

ON HI'DEN STFM'S ADD A 6 X 6 C.R.S. PLATE WITH TAPPED HOLE FOR EYEBOLT. THE THICKNESS OF PLATE AND TAPPED HOLE SIZE SUITABLE FOR WEIGHT AND SIZE OF STFM. EYEBOLT SIZES AVAILABLE ARE 1/2-13, 5/8-11 AND 3/4-10. BOLT PLATE TO FORM (NO LAG SCREWS).

DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TYPICAL CONSTRUCTION
HUFFORD STRETCHER FORMS
CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

TOOL FABRICATION PROCEDURES MANUAL
PAGE 162



NOTES:

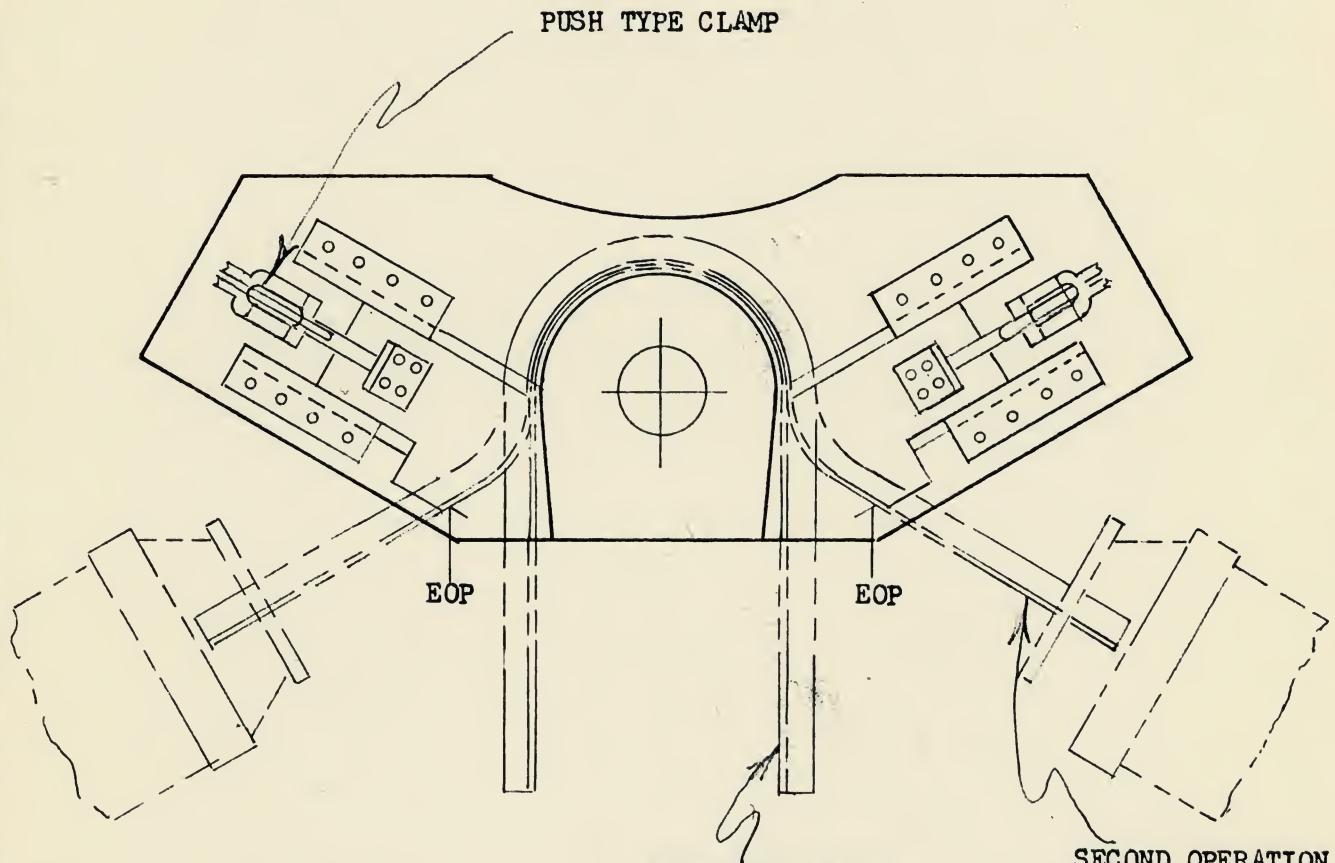
1. ALLOW 12" ADDITIONAL STOCK AT EACH END FOR GRIPPING.
2. FORM MUST BE BUILT SO CLEARANCE IS PROVIDED FOR STRETCHER JAWS AT ANY POSITION WHEN PART IS BEING FORMED.
3. STFM & BULLDOZER BLOCK USED ON SHERIDAN STRETCH PRESS.

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

REVERSE BEND STRETCH FORMING
FOR HUFFORD

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NOTES:

1. ALLOW 12" ADDITIONAL STOCK AT EACH END FOR GRIPPING.
2. FORM MUST BE BUILT SO CLEARANCE IS PROVIDED FOR STRETCHER JAWS AT ANY POSITION WHEN PART IS BEING FORMED.
3. STFM WITH BULLDOZER ATTACHMENT USED ON SHERIDAN STRETCH PRESS.

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

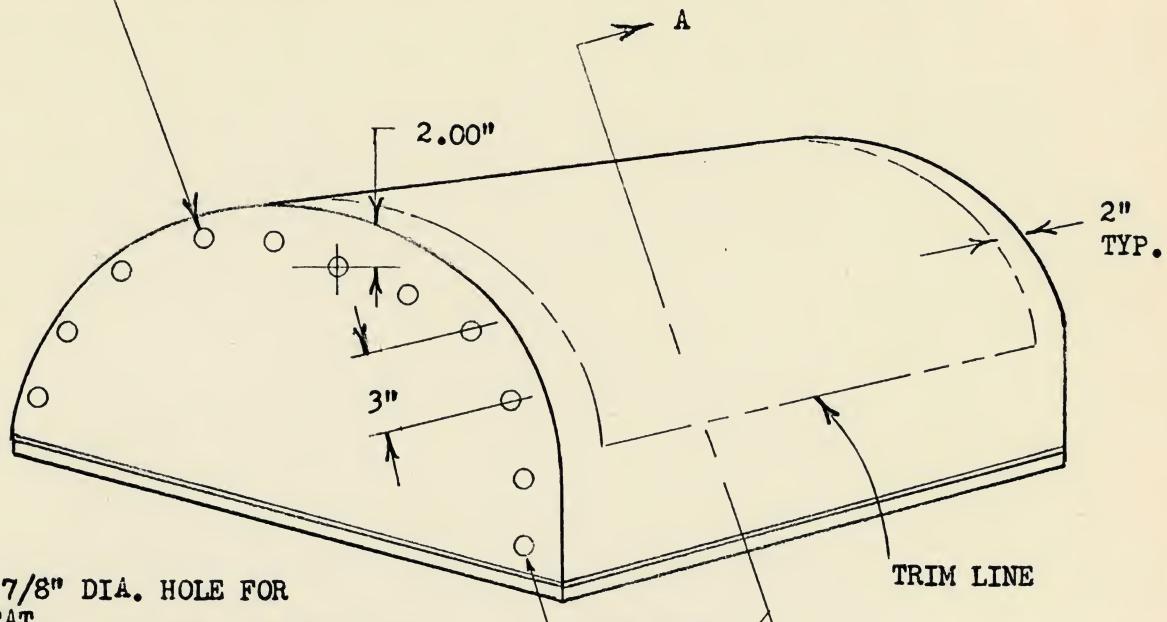
REVERSE BEND STRETCH FORMING
FOR HUFFORD

CONVAIR
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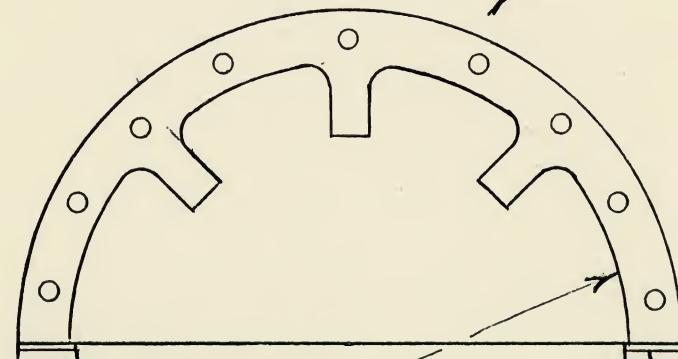
S.A.E. 4130 TUBING 1" O.D. X .058 WALL



NOTES:

1. PROVIDE 7/8" DIA. HOLE FOR THERMOSTAT.
2. TUBES FOR TUBULAR HEATERS ARE TO BE CAST IN PAIRS ON 3" CENTERS. TUBE SHOULD NOT PROTRUDE.
3. FAB. TO "TOPA"

MATERIAL
CAST KIRKSITE OR
CAST ALUMINUM



1/16" STD. ASBESTOS SHEET
MILLBOARD JOHNS-MANVILLE

1/4" ALUMINUM ALLOY STRIPS
ATTACH WITH FLAT HD. SCREWS

DRAWN	CAME 10-30-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TYPICAL HEATED STRETCH FORM FOR MAGNESIUM

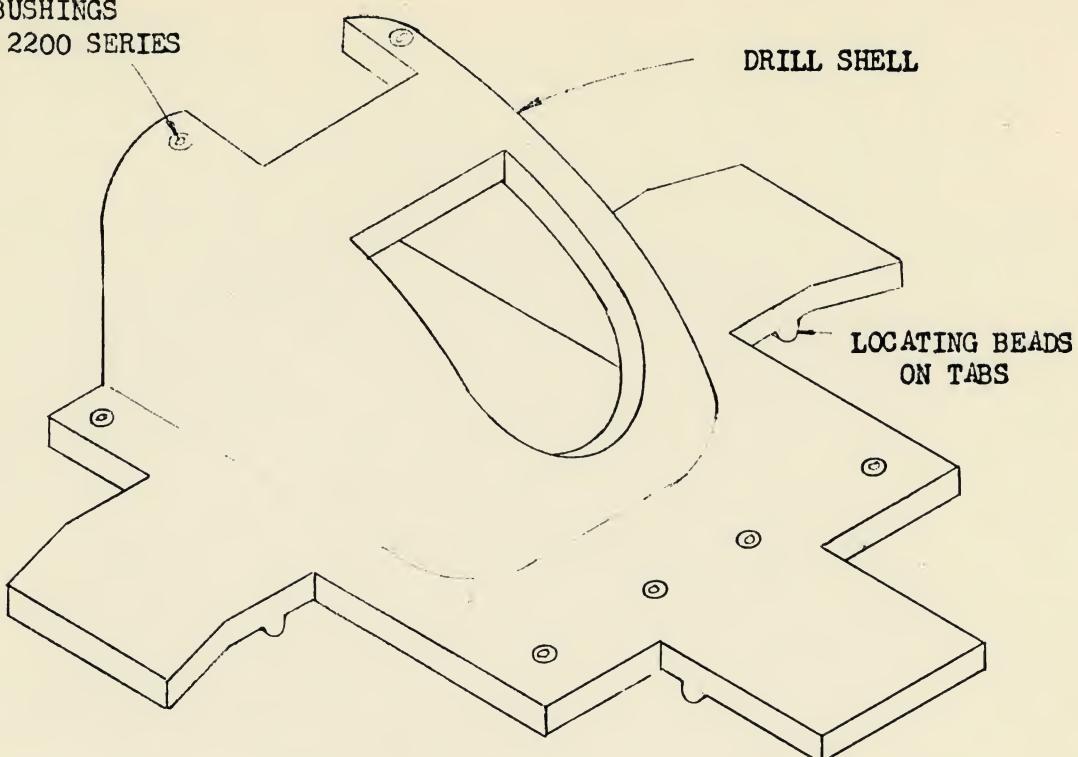
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MANUAL

PAGE 165

SERRATED BUSHINGS
CVAC BUS. 2200 SERIES

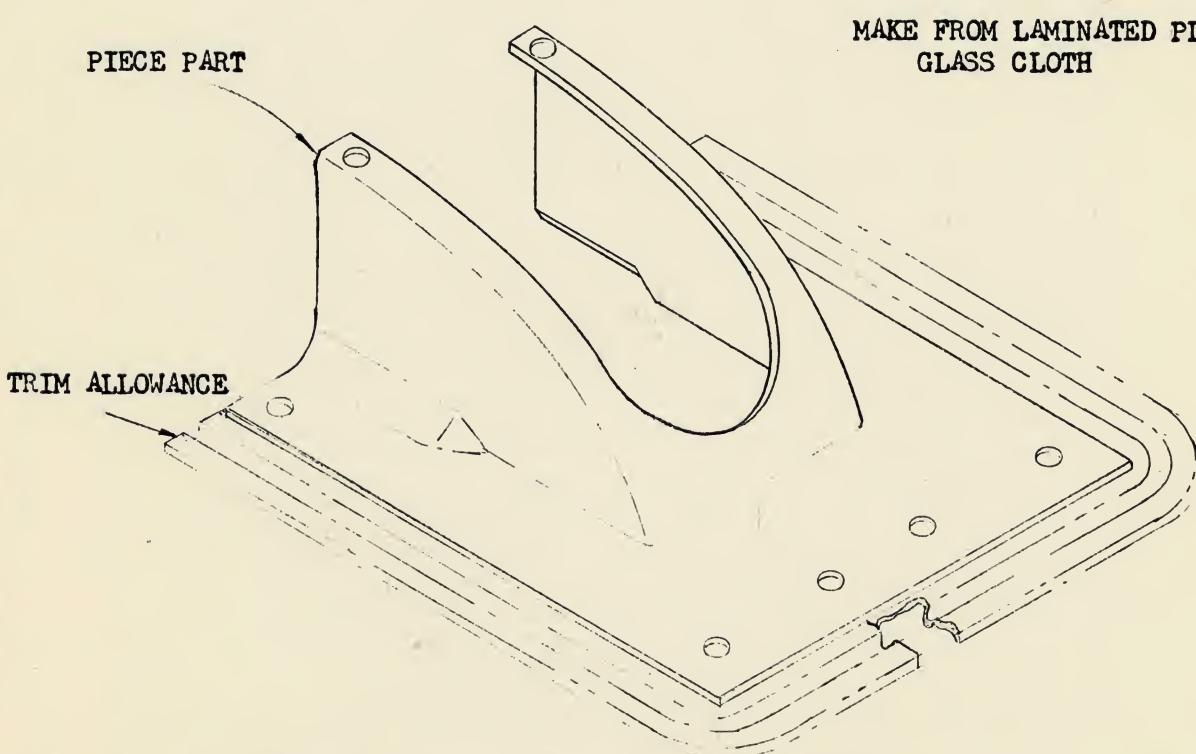
DRILL SHELL



PIECE PART

MAKE FROM LAMINATED PLASTIC
GLASS CLOTH

TRIM ALLOWANCE



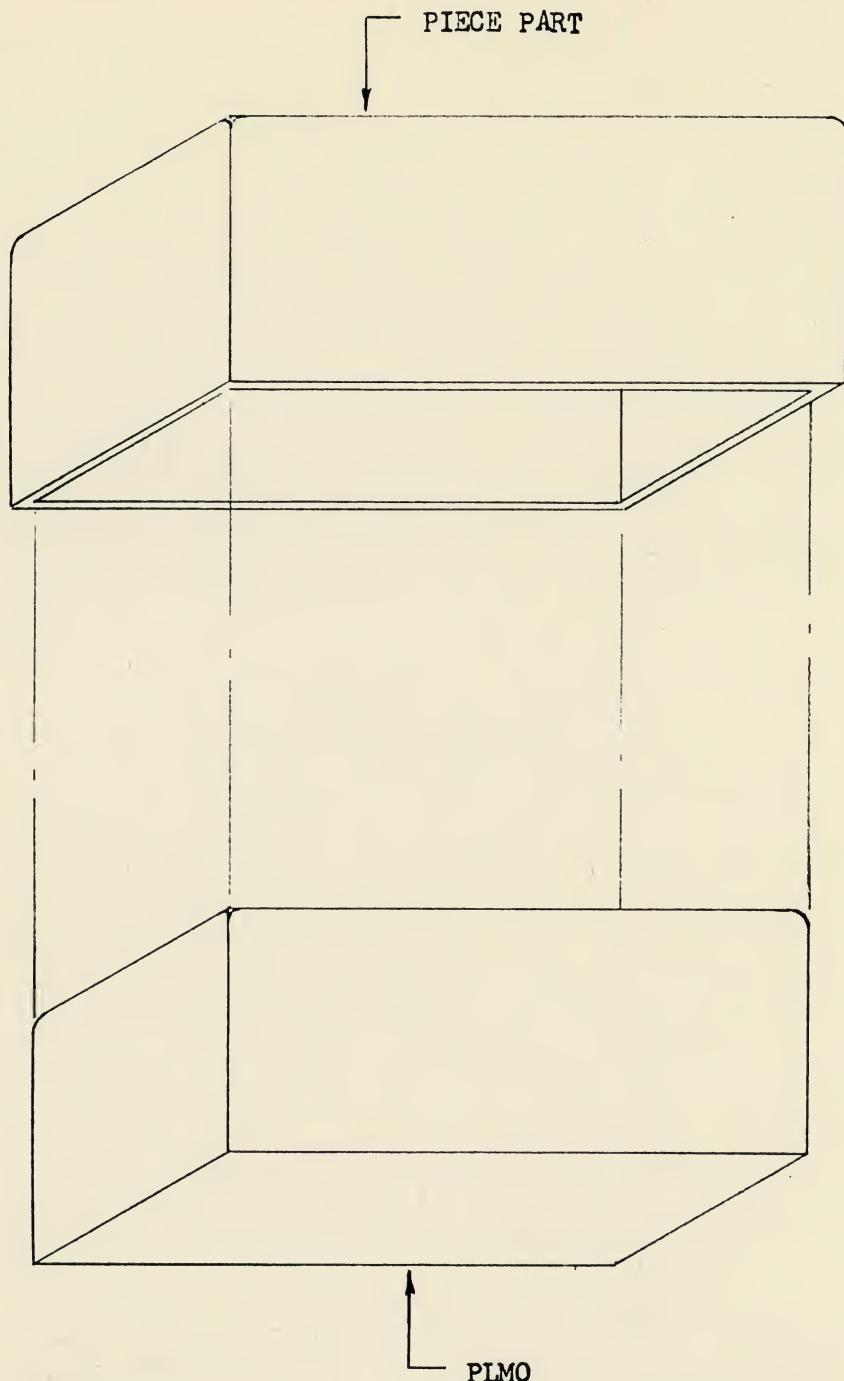
DRAWN	GORDON	1-23-5
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

DRILL SHELL
TOOL ILLUSTRATIONS

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TOOL FABRICATION
PROCEDURES
MANUAL

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PLASTIC IS LAID UP DIRECTLY
ON PLMO AND AFTER CURING
STRIPPED FROM MOULD

MATERIAL - DURAL OR PLASTER

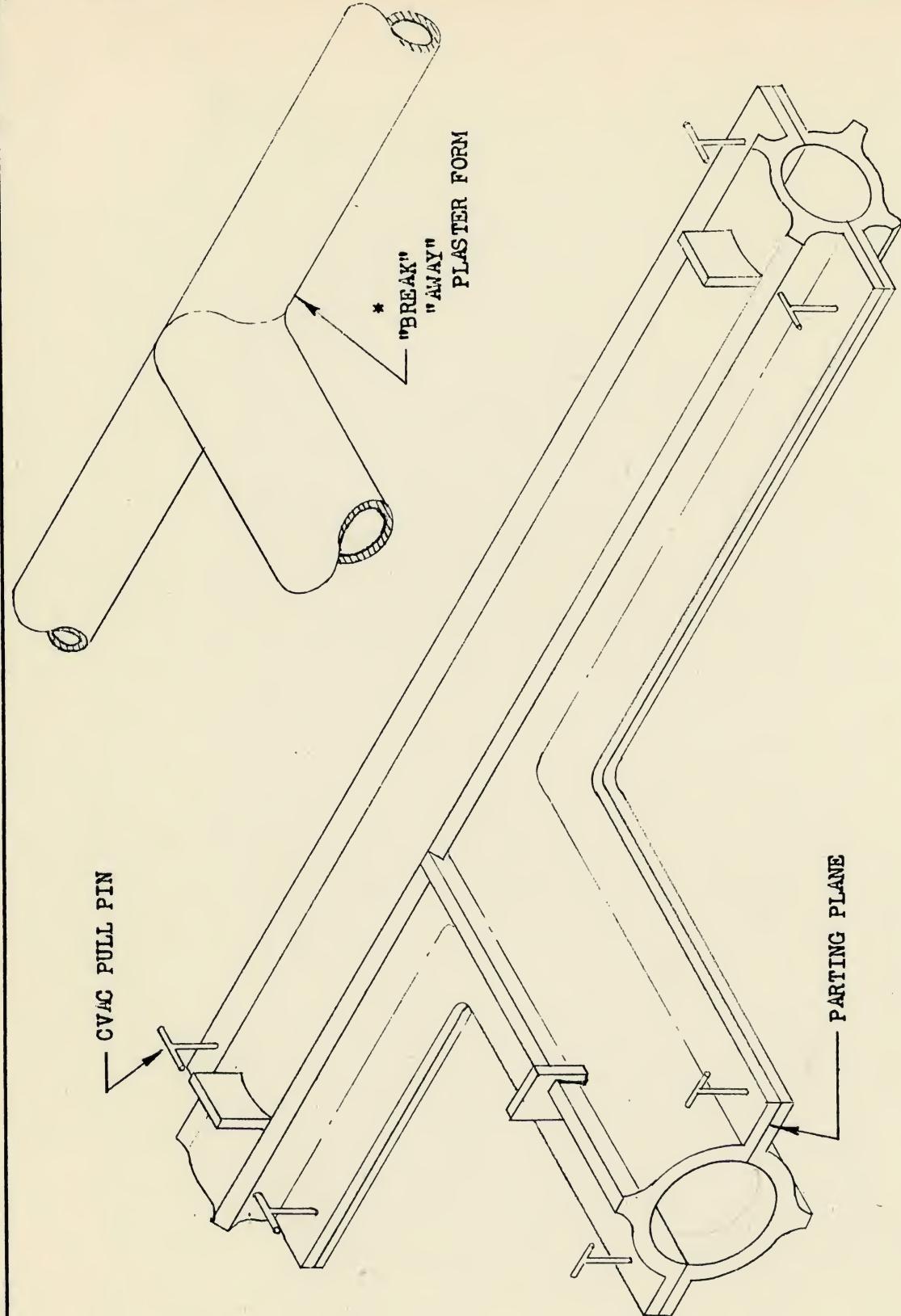
DRAWN	GORDON	11-1-56
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

PLASTIC MOULD "PLMO"
TOOL ILLUSTRATION

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LAMINATED PLASTIC GLASS
CLOTH CONSTRUCTION

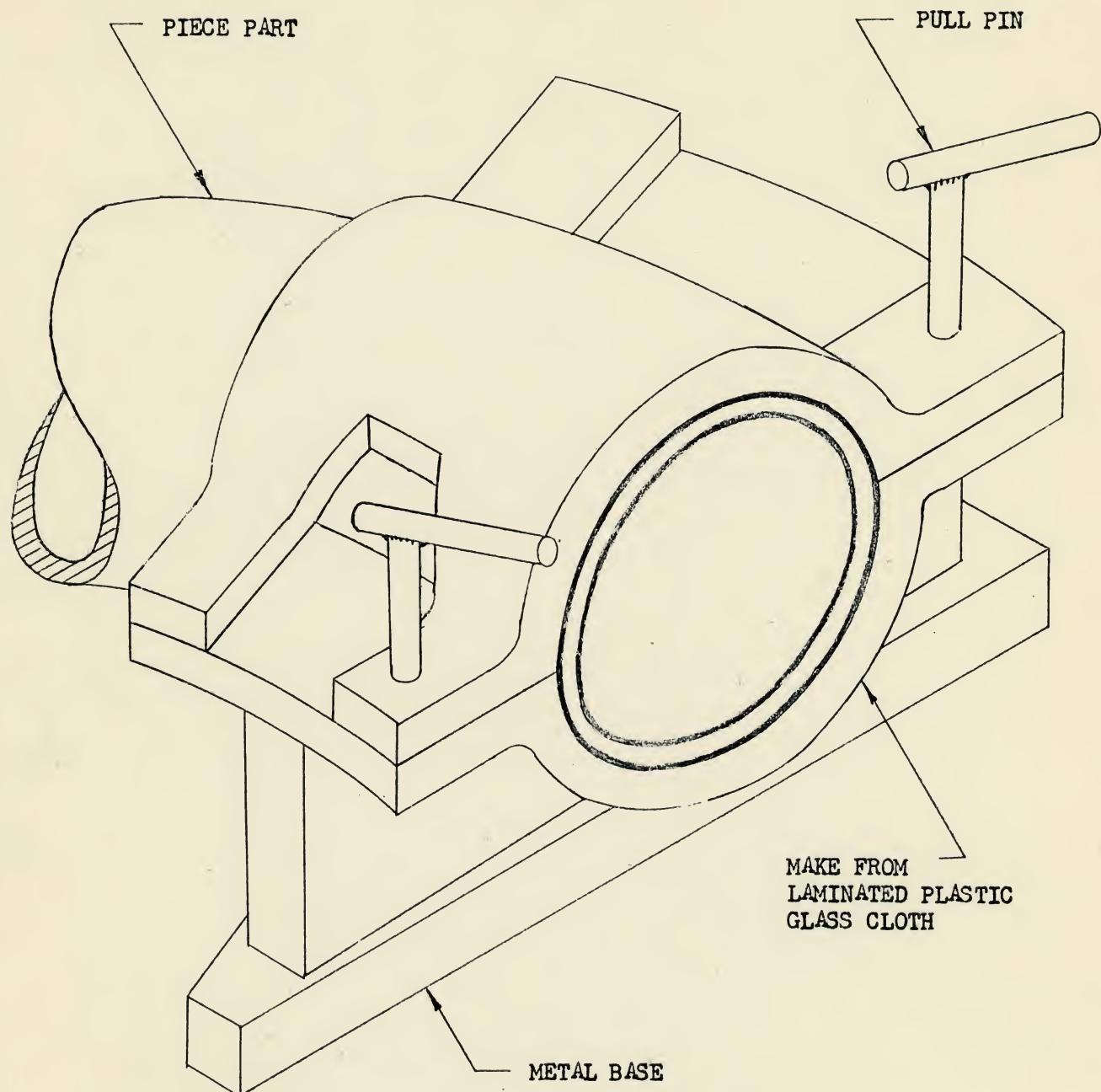
* PLASTIC IS LAID UP ON PLASTER
CAST MADE IN PLMO AND AFTER CURING
PLASTER IS BROKEN OUT TO LEAVE
PART.

DRAWN	GORDON	10-298
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

PLASTIC MOULD "PLMO"
TOOL ILLUSTRATION

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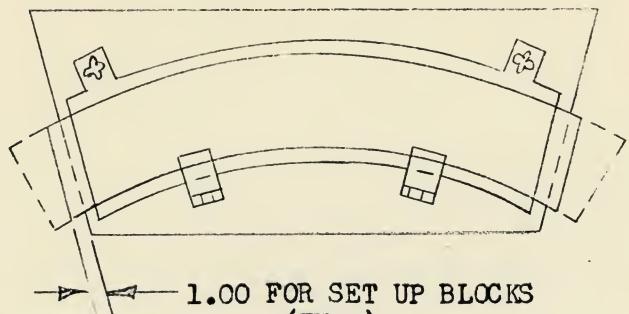
DRAWN	GORDON	10-25-X
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

SAW FIXTURE "SAFX"
TOOL ILLUSTRATION

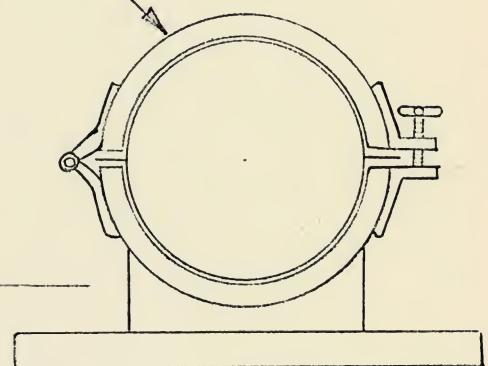
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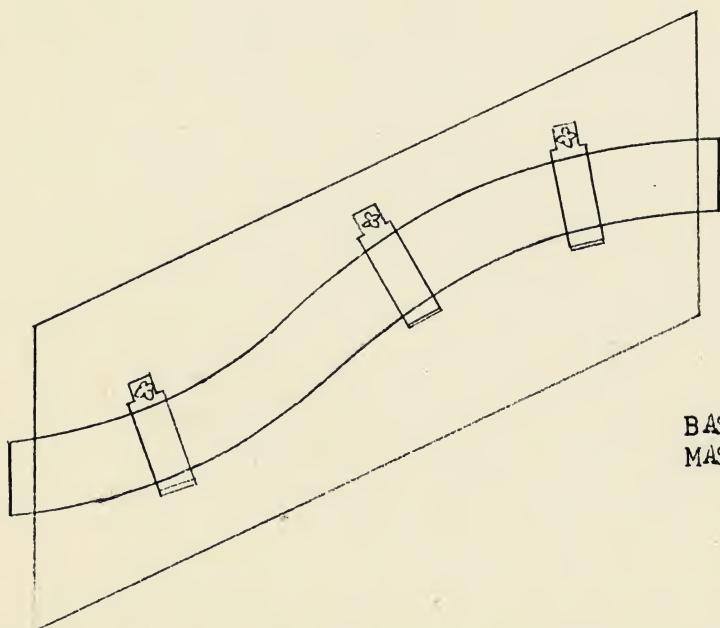
PAGE 173



LAMINATED FIBER-GLASS CLAMPS



KEEP AS LOW AS PRACTICAL
FOR SAFETY.



BASE TO BE MADE OF
MASONITE OR DURAL

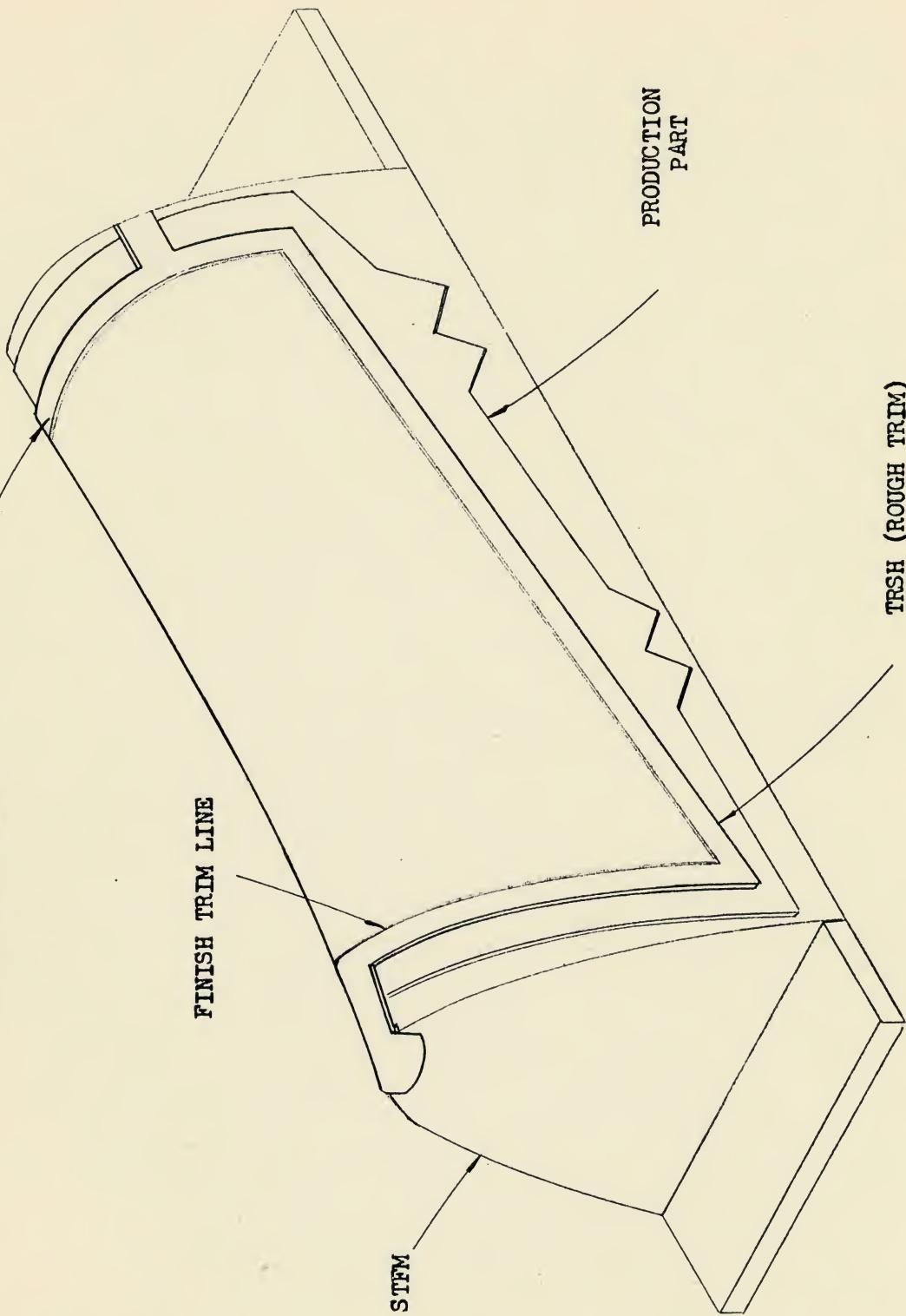
DRAWN	CAME 10-29-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

TYPICAL SAW FIXTURES
FOR DUCTS

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DIFFERENCE BETWEEN ROUGH & FINISH
MARKED AND PAINTED YELLOW. REST OF
TRSH PAINTED RED.



* CAN BE MADE OF SHEET METAL

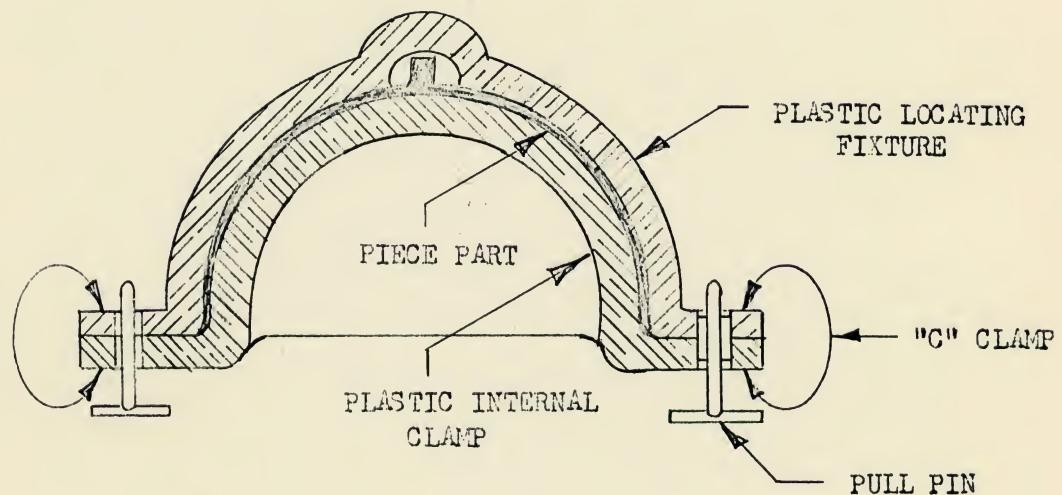
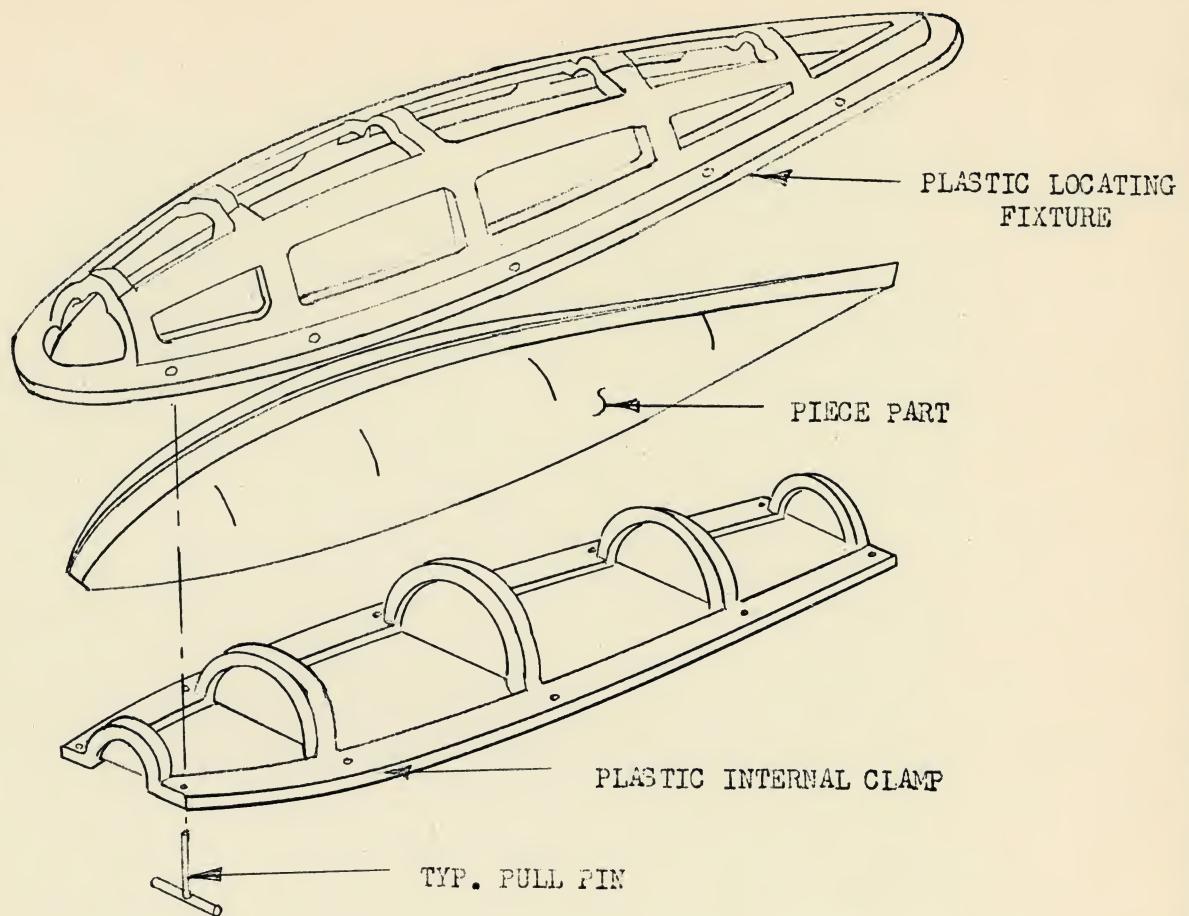
DRAWN	GORDON	10-23-56
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

TRIM SHELL
TOOL ILLUSTRATIONS

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TOOL FABRICATION
PROCEDURES
MANUAL

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TYPICAL CROSS SECTION

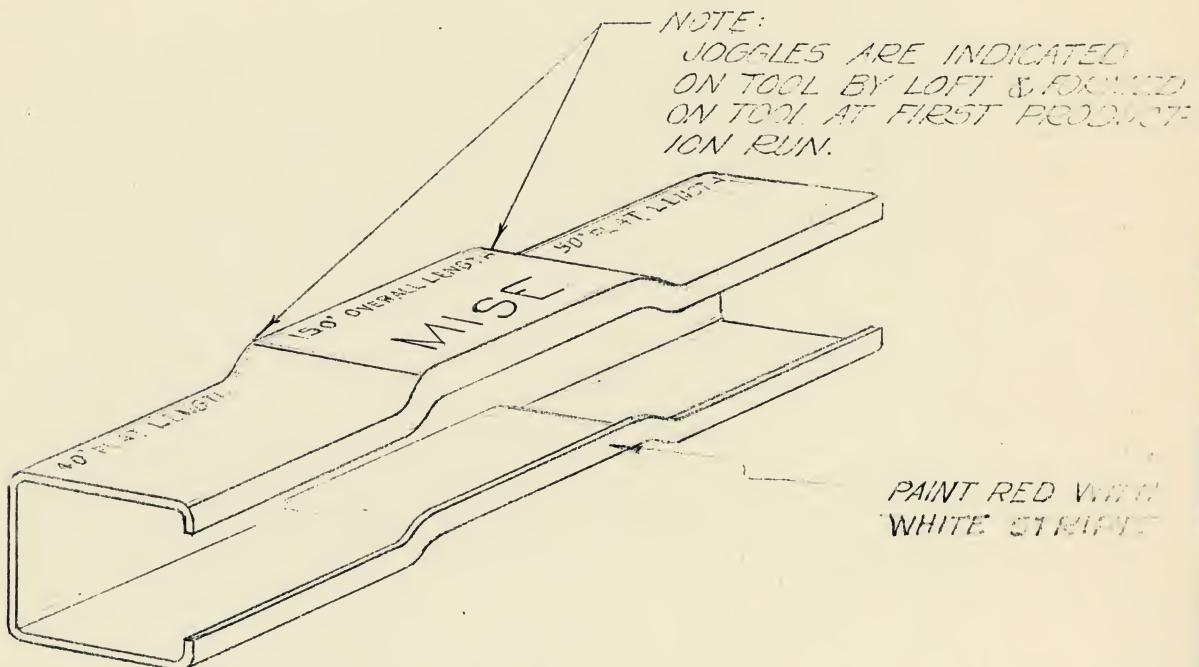
DRAWN	CAME 10-22-56
CHECKED	ROBBINS 10-25-56
APPROVED	
APPROVED	

TYPICAL EXAMPLES OF PLASTIC TOOLING
APPLICATIONS FOR WELD FIXTURES

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A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

TOOL FABRICATION
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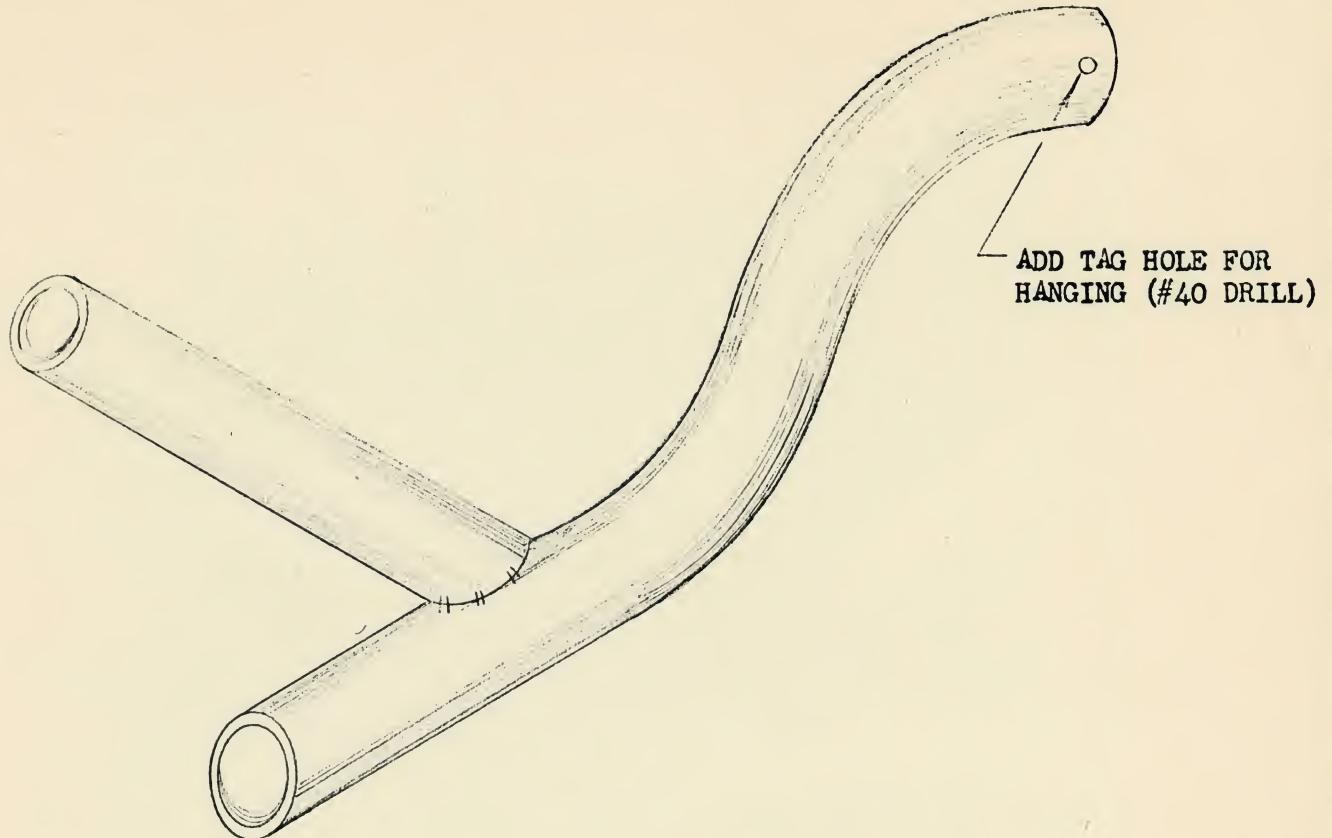


MINIATURE SAMPLE

A part having all aspects of a part made to fit an assembly, but reduced in size, with the true dimensions clearly stamped on the sample. All cut-outs, joggles, holes, etc., which can be shown in their true relation to the ends or sides of the part will be on the sample. Long constant sections may be reduced in length or width, whichever is the case.

REVISED

DRAWN	CASE 10-26-56	MINIATURE SAMPLE	TOOL FABRICATION PROCEDURES MANUAL
APPROVED	ROBBINS 11-1-56		
APPROVED			
ISSUED		CONSOLIDATED VULTEE AIRCRAFT CORPORATION SAN DIEGO DIVISION . . SAN DIEGO, CALIFORNIA	PAGE 180



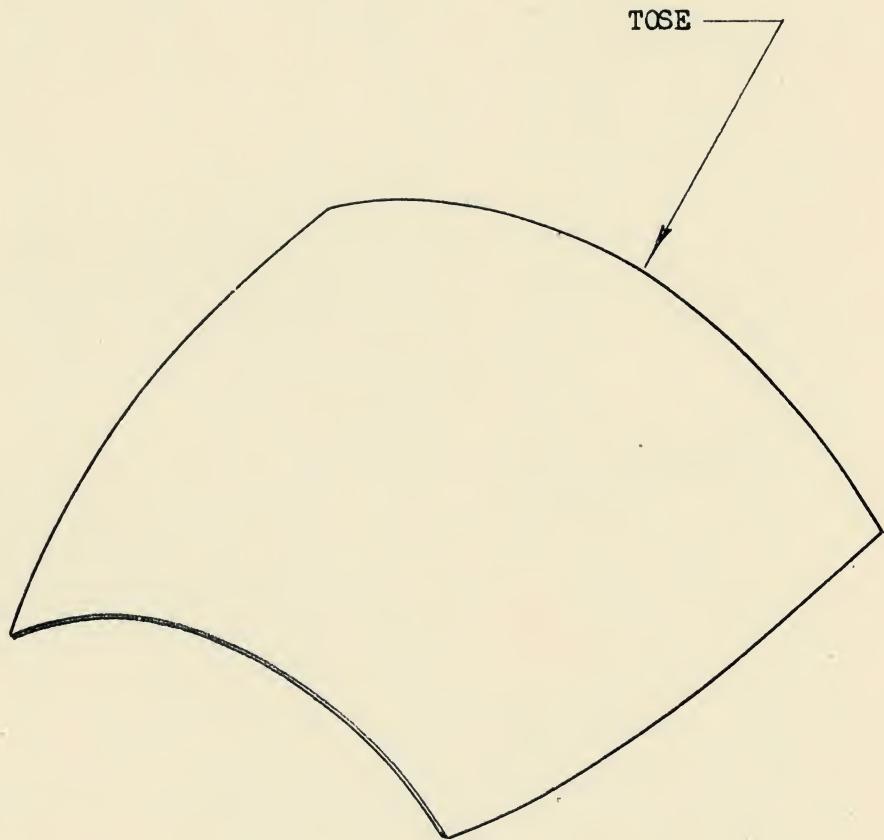
PRODUCTION SAMPLE

A PART MADE TO SET AN ASSEMBLY FROM WHICH ALL OTHER PARTS ARE COPIED. THE MATERIAL THE PRODUCTION PART IS MADE OF IS INDICATED ON THE SAMPLE. THIS TOOL IS TO BE USED ONLY FOR STRUCTURAL TUBING, DETAIL PLANNING AND IN THE ELECTRIC, TUBING, AND FABRICATION PLANNING. RARELY USED AS A SET-UP TOOL IN MACHINE SHOP. THE PRODUCTION SAMPLE IS DISTINGUISHED FROM A PRODUCTION PART BY PAINTING THE SAMPLE. THE COLOR OF WHICH IS CODED AND CONTROLLED BY PROOF PLANNING BY MODELS.

DRAWN	CAME 10-26-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

PRODUCTION SAMPLE "PDSE"
CONVAIR
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TOOLING SAMPLE IS MADE TO FIT AN ASSEMBLY,
TO WHICH TOOLS ARE CHECKED. HOLES ARE MADE
ACTUAL OR PILOT SIZE. THE MATERIAL OF PRO-
DUCTION PART IS INDICATED ON SAMPLE. THE
TOOLING SAMPLE IS PAINTED GREEN.

DRAWN	CAME 10-25-56
CHECKED	ROBBINS 11-2-56
APPROVED	
APPROVED	

TOOLING SAMPLE "TOSE"
TOOL ILLUSTRATION

CONVAIR
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THE FOLLOWING N.A.S. DEFINITIONS AND CONVAIR-SD EQUIVALENT DEFINITIONS AND TERMS ARE TO BE USED FOR REFERENCE ONLY. CONVAIR-SD STANDARD DEFINITIONS WILL CONTINUE TO BE USED AS HERE-TO-FORE.

TERMINOLOGY FOR MASTERS DEFINITION & PREFERRED TERMS

CONVAIR-SD
EQUIVALENT TERMS

MASTER (GENERAL)

A MASTER IS THE AUTHORITY WHICH PHYSICALLY ESTABLISHES NOMINAL DIMENSIONS AND WHICH CONTROLS THE ACCURACY OF AIRCRAFT TOOLS SO THAT PARTS AND/OR ASSEMBLIES MAY BE PRODUCED WITHIN ALLOWABLE TOLERANCE TO THESE NOMINAL DIMENSIONS.

SAME

I MASTER-CONTROL

A CONTROL MASTER IS A DIMENSIONAL AUTHORITY TO CONTROL THE ACCURACY OF A MASTER OR MASTERS, AND SUPERSEDES THE MASTER AS THE AUTHORITY.

MSG A, MSLO, MSPE,
TOM L

PURPOSES: 1. A CONTROL MASTER IS NORMALLY REQUIRED:

(A) FOR THE FABRICATION AND CONTROL OF A MASTER OR DUPLICATE MASTERS SO AS TO SATISFY THE REQUIREMENT OF A PRODUCTION PROGRAM.

MSG A, MSLO, MSPE,
TOM L

(B) TO GUARD AGAINST LOSS OF DIMENSIONAL CONTROL IN CASE OF POSSIBLE DAMAGE TO MASTERS OR MASTERS.

MSG A, MSLO, MSPE,
TOM L

II MASTER - (SPECIFIC)

A MASTER IS THE DIMENSIONAL AUTHORITY FOR THE CONSTRUCTION AND CONTROL OF PRODUCTION TOOLS, ESTABLISHING THE RELATIONSHIP BETWEEN HOLES, SURFACES, AND/OR CONTOURS OF A SPECIFIC PART, MATING PART, OR ASSEMBLY, OR A PORTION THEREOF.

FCGA, MSSE, MSTP,
TOFM, TOGA, TOLO,
TOM L, TOPE, TOTP

PURPOSES: 1. TO INSURE INTERCHANGEABILITY BETWEEN AIRFRAME PARTS AND/OR ASSEMBLIES WHERE TOLERANCES REQUIRED ARE NOT COMPATIBLE WITH ORDINARY PRACTICAL MANUFACTURING PROCEDURE.

FCGA, TOGA, TOM L,
TOPE

2. TO FABRICATE AND CHECK AIRCRAFT PRODUCTION AND INSPECTION TOOLS, PARTICULARLY WHERE DUPLICATE TOOLS ARE REQUIRED.

FCGA, TOLO, MSSE,
TOM L, MSTP, TOFM,
TOPE, TOGA, TOTP

3. TO DEFINE HOLE PATTERNS, CONTOURS, SURFACES, AND/OR CRITICAL ATTACH POINTS; IN GENERAL SIMULATING THE PRODUCTION PART OF ASSEMBLY BEING CONTROLLED.

FCGA, TOFM, TOGA,
TOM L, TOPE

DRAWN	CAME 11-1-56	
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

TERMINOLOGY FOR MASTERS NATIONAL AIRCRAFT
STD S. & CONVAIR EQUIVALENT TERMS

CONVAIR
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CONVAIR-SD
EQUIVALENT TERMS

II. MASTER - (SPECIFIC) (CONT'D)

PURPOSES: 4. TO COORDINATE MASTERS OF ADJACENT AND/OR MATING PARTS OR STRUCTURES.

TOGA, TOML, TOPE

III. MASTER-PART

A PART MASTER IS AN ACCURATELY CONSTRUCTED PRODUCTION PART MADE TO NOMINAL DIMENSIONS, AND ACCEPTED AS THE DIMENSIONAL AUTHORITY FOR THE FABRICATION AND/OR CO-ORDINATION OF TOOLS.

MSSE, TOSE

PURPOSES: 1. TO FABRICATE & CHECK AIRCRAFT PRODUCTION AND INSPECTION TOOLS.

MSSE, TOSE

2. TO SERVE AS A MASTER IN LIEU OF A SPECIFICALLY DESIGNED MASTER WHERE CLOSE DIMENSIONAL CONTROL IS NOT REQUIRED.

MSSE, TOSE

3. TO SERVE AS A MASTER WHERE CLOSE DIMENSIONAL CONTROL IS REQUIRED WHEN THE PART IS INHERENTLY DIMENSIONALLY STABLE, SUCH AS MACHINES CASTINGS OR FORGINGS.

TOSE

IV. MASTER-FACILITY TOOL

A FACILITY TOOL MASTER IS AN AUXILIARY MASTER CONTROLLED BY ANOTHER MASTER TO FACILITATE TOOL MANUFACTURE AND/OR CONTROL. ADDITIONAL CONTOURS OR POINTS MAY BE ADDED WHICH ARE NOT CONTROLLED BY ANOTHER MASTER.

FCGA, TOGA, TOML,
TOPE

PURPOSES: 1. TO EXPEDITE THE CONSTRUCTION AND CHECKING OF TOOLS WHEN THE MASTER IS LARGE OR CUMBERSOME.

FCGA, TOGA, TOML,
TOPE

2. TO PROVIDE CONTROL OVER ADDITIONAL POINTS OR CONTOURS NOT ORIGINALLY INCLUDED IN THE MASTERING PROGRAM.

FCGA, TOGA, TOML
TOPE

3. TO SERVE AS A TRANSFER MEDIA.

TOGA, TOML, TOPE

V. MASTER-MODEL

A MODEL MASTER IS A FULL SCALE, THREE-DIMENSIONAL STRUCTURE WHICH ESTABLISHES THE COMPLETE OUTSIDE (OR INSIDE) SURFACES OF THE PART OR ASSEMBLY, AS DEFINED BY DESIGN-ENGINEERING DATA AND/OR LOFT LINES, AND MAY CARRY OTHER COORDINATING DATA, SUCH AS, TRIM LINES AND HOLES.

TOML

PURPOSES: 1. TO MAKE CASTS FOR DIES, FORM TOOLS, ETC.

TOML

DRAWN	CAME 11-1-56
CHECKED	ROBBINS 11-1-56
APPROVED	
APPROVED	

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TERMINOLOGY FOR MASTERS DEFINITION & PREFERRED TERMSCONVAIR-SD EQUIVALENT TERMS

V. MASTER-MODEL (CONT)

- PURPOSES: 2. TO CONTROL CONTOURED AREAS NOT DEFINED BY ANY OTHER MEDIA.
3. TO COORDINATE DETAIL AND ASSEMBLY TOOLS.

TOML

TOML

VI. MASTER-DRILL PLATE

A DRILL PLATE MASTER IS A MASTER THAT DEFINES A PATTERN OF HOLES IN A SINGLE PLANE, RELATING THEM TO REFERENCE POINTS, LINES, OR CONTOURS.

MSPE, TOPE

- PURPOSES: 1. TO INSURE INTERCHANGEABILITY OF HOLE PATTERNS BETWEEN TWO MATING PARTS OR ASSEMBLIES.
2. TO FABRICATE & CHECK AIRCRAFT PRODUCTION AND INSPECTION TOOLS.
3. TO SERVE IN SOME CASES AS A CONTROL MASTER.

TOPE

TOPE

MSPE

VII. MASTER-TEMPLATE

A TEMPLATE MASTER IS A MASTER WHICH DEFINES CONTOUR AND/OR HOLE LOCATIONS IN A PLANE, AS RELATED TO REFERENCE POINTS OR LINES.

MSLO, MSTP, TOLO,
TOTP

- PURPOSES: 1. TO CONTROL WORKING TEMPLATES USED IN THE CONSTRUCTION OF DETAIL-PART TOOLS, SUCH AS, FORM BLOCKS, ROUTER BLOCKS, ETC.
2. TO SUPPLEMENT MASTERS IN THE CONSTRUCTION OF ASSEMBLY TOOLS.
3. TO AID IN THE CONSTRUCTION OF MASTERS
4. TO SERVE IN LIEU OF A DRILL PLATE MASTER WHEN HOLE LOCATION IS LESS CRITICAL.

MSLO, MSTP

TOLO, TOTP

TOLO

TOLO

DRAWN	CAME 11-1-56	
CHECKED	ROBBINS	11-1-56
APPROVED		
APPROVED		

TERMINOLOGY FOR MASTERS NATIONAL AIRCRAFT
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